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AVIATION

OCTOBER 1946

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N THIS ISSUE

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w's and why's of it-growing means improving produc- on both in primary d secondary struc- res.

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eprint for merging many ied interests into one co- nated program to advance h aviation and the com- nity.

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McGRAW-HILL
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AVIATION

CONTENTS FOR OCTOBER, 1946

Volume 45 • No. 10

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GEORGE TENNEY is chairman of the San Francisco Chamber of Commerce Aviation Committee, a group which has gained plenty of distinction by getting airminded people of nine different counties to work together—and most successfully—on one overall aviation program. Incidentally, George is vice-president of McGraw-Hill Publishing Co., heading up its West Coast activities. And, lest the cry of nepotism rear its ugly head, let us say we're printing this story "Putting Your Community On the Airmap" (page 38) not because he's a v-p., but because the article can be of tremendous value not only to the aviation industry, but to all cities and towns which put it to use.

Personal airplane comfort and utility, like the weather, have heretofore been the subject of a lot of conversation but not much action. Now comes William L. Lewis with a completely fresh approach to these sorely neglected factors. Lewis presents (page 55) a new idea in aircraft design, for he *starts* by considering the plane's occupants—and it's fascinating how the usually-first considerations of performance and production efficiency fall into their proper places when you go at the problem from the standpoint of building an airplane around people, not trying to squeeze them into what room may be left.

Whether we like it or not, we still seem to have to keep training men to put bombs—atomic bombs at that—exactly where they're supposed to go. One dividend of the recent Bikini tests was a new means of evaluating aircrews to measure and raise their efficiency. Scholer Bangs dug this story out when he represented AVIATION at the tests and, with the system's mentor, Col. William H. Blanchard, put it into its most readable form. Turn to page 44.

One of these days—and possibly very soon—manufacturers and distributors of American planes of all sizes are going to find themselves needing a good export market to help keep their engineering and production staffs together. But selling abroad, particularly in Latin America, isn't the same as it is here; for there are a lot of different rules to observe. Ray Hoadley, our man-about-economics, is also a close student of foreign trade, and in his article on pages 42 and 43 he has information that's mighty important to all those who are trying to get in, or stay in, what can be a highly lucrative field.

The feeling seems to be rampant that "there's gold in them thar oil companies"—that all an airport operator has to do is ask and they'll gladly finance hangars and everything. Frank Brine dug into the situation to get the low-down—and what he found is revealed in the story on page 47.

Problem of getting airplanes in the air with larger payloads is another of those perennials, and it probably will never be solved by one single factor. One of the most successful approaches, of course, is assisted takeoff. And on page 62 we present a new development in this phase, with M. F. Jones, Westinghouse design engineer, giving the details on the new Electropult, a unit successfully used by the Navy on craft up to four engines—bomber size—with designs proven for even larger craft.

And here's the lineup of craft considered in this month's Flying Equipment section: Boeing's Stratofreighter type (page 81), Waco's new four-seat Aristocraft (pages 82 and 83), the Duckling personal amphib (page 84) and three new 'copter test-craft produced, respectively, by McDonnell, Firestone, and Bendix (page 85).

Down the Years in AVIATION'S Log

25 Yr. Ago (1921) — *USS Alabama* sunk in bombing tests. . . . Zeppelin builds 1,000-hp. 4-engine transport seating 18 . . . Gliders at German soaring meet climb 300 ft. and travel 6 mi. from starting point. . . . Army drops 4,300-lb. bomb from 4,100 ft., blasting out crater 100 ft. across by 30 ft. deep. . . . Newly formed Aero Club of Uruguay backs legislation banning cruising lower than 1,650 ft. altitude . . . Army considers use of parachutes for pilots. . . . Kirsch, flying in Nieuport-Delage at 173 mph., wins Deutsch Trophy, as two other contestants crash because of stripped fabric . . . John M. Larsen is donor of $8,000 award for aircraft efficiency . . . Army makes first tests of all-metal wing.

15 Yr. Ago (1931) — England wins Schneider Trophy permanently when Supermarine S6B is flown by Lt. J. N. Boothman at 340 mph. . . . Maj. James Doolittle flies Wasp-engined Laird across continent in 11 hr. 18 min. . . . Do-X flies 300 mi. from Norfolk to N. Y. in 3 hr. 15 min., carrying 70 passengers and crew. . . . Frank Hawks flies Chicago-N. Y. in 3 hr. 46 min. . . . Air Corps buys 71 planes and 92 engines . . . Mexico passes air laws compelling airliners to carry co-pilot . . . Dirigible *Akron* makes successful 3¾ hr. flight with 113 on board . . . Air Commerce Regulations require left turns when circling airport for landing.

10 Yr. Ago (1936) —Fleetwings builds stainless steel Seabird amphibian. . . . Army buys Seversky XBT Wasp-engined trainer. . . . Curtiss-Wright P-36 is first "mystery" fighter . . . Cartridge engine starter is invented by Coffman . . . Dornier Do-18 flying boat Zephir flies 2,390 mi. across Atlantic in 22 hr. after catapult launching from mother ship *Schwabenland*. . . . Year's first-half production in U. S. was 1,363 aircraft . . . Bendix starts building $1,000,000 plant on West Coast . . . Dick Merrill pilots Harry Richman to England in Wright Cyclone-powered Vultee in 18 hr. 8 min., returning in 17 hr. 24 min. . . . Aircraft carrier *Enterprise* launched at Newport News, Va.

The Navy's NEW Seahawk

—for Reconnaissance and Rescue

Drawing on the wartime Seahawk's extensive service with the Pacific fleet, Navy and Curtiss-Wright engineers have developed the SC-2, a new scout plane of unprecedented range, speed, firepower, and general utility.

More room in the fuselage, with an extra seat aft of the pilot, provides for air-sea rescue work or for reconnaissance photography. Firepower has been increased beyond that of previous types by the installation of rockets under the wing. The new, hydraulically operated cabin enclosure is equipped for quick opening by compressed air in emergencies. A Wright Cyclone engine with two-speed supercharger gives the SC-2 a service ceiling of 29,000 feet, and provides increased range and speed. It is equipped with a Curtiss Electric hollow steel blade propeller.

The Seahawk is now being delivered to the Navy from the Curtiss-Wright, Columbus, Ohio, plant.

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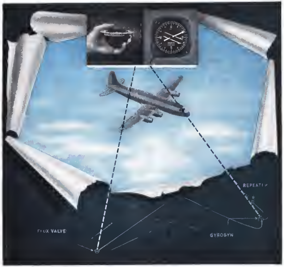
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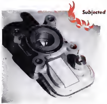

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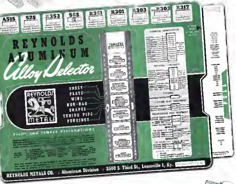

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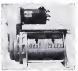

A typical example of Western Gear Works' advanced designing is this cable hoist being used in a new super transport airplane. Actuator will spool 4 cables 5 feet each in one minute at 2,500 lbs. per cable. Reduction ratio 1,508:1.

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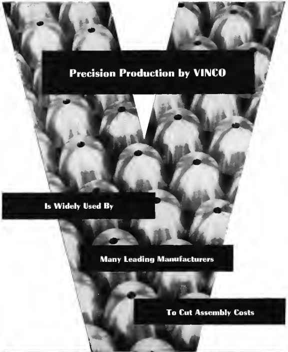

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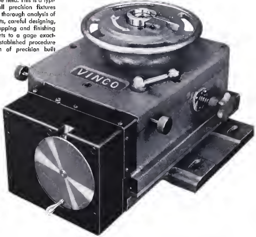

They Came To VINCO

With a tough production job. Toil and sweat had convinced the Brenkert Light Projection Company, a subsidiary of Radio Corporation of America, that the star part, shown on the opposite page, would require an overall accuracy to within .0001" if it were to function at its planned efficiency. Twenty-four times each second this part must start and stop and, between each pause, attain a speed of 3485 R.P.M. Such performance called for accuracy to the Nth degree and Brenkert knew they needed the "tops" in gages and fixtures to attain and hold such close limits so;

They Came to Vinco

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A FREE ECONOMY IS WORTH FIGHTING FOR

BUSINESS must take the initiative if the price decontrol machinery, set up by Congress, is to be effective. The present price control law is far more than a set of instructions to the administrators of OPA; it is a challenge to business to be aggressive in speeding decontrol decisions and in persuading the Price Decontrol Board to adopt a strong stand for return to a free economy.

Thus far business has not met this challenge. *Two months after the passage of the new price law not a single application for decontrol of a major product had been filed by an industry advisory committee.* This is due in part to the red tape controlling such applications. Nonetheless, a continuation of such inactivity on the part of business can well result in perpetuating price control far beyond the time either the present law or sensible economic policy require.

It was the clear intent of Congress to hasten our return to a free economy. In the legislation continuing the general control of prices, Congress formally declared its purpose to have it "terminated as rapidly as possible."

To accomplish this, the House originally approved a formula which would have made decontrol mandatory when production had attained a prescribed level. The automatic decontrol provision was dropped before the bill was finally passed, partly because of the uncertain effects of strikes on production. But Congress did not mean to return the timing and extent of decontrol to the administrative discretion of OPA.

On the contrary, to assure having price control "terminated as rapidly as possible," Congress created a Price Decontrol Board and gave it power to overrule OPA when the board finds price control should be removed. Moreover, it gave to industry the right and the responsibility to seek decontrol. Also, in a further effort to speed up the decontrol process, it placed narrow limits on the time allowed for board decisions.

Congress had compelling economic reasons for doing its legislative best to speed up decontrol.

1. It is by all odds the best way to eliminate the bottlenecks in production and the black markets which have plagued the country since V-J Day.

> Rigid price ceilings promote shortages of badly needed commodities by discouraging their production. Such shortages both upset the flow of production and promote black markets At present a considerable part of American industry is stymied by shortage of critical parts and materials. Price control is much to blame.

2. There must be flexibility of prices if a round of new wage adjustments, which may be forced on industry early in 1947, is to be negotiated without grave risks of seriously curtailing production.

> When, under the leadership of the national administration, the first post V-J Day round of wage adjustments was made, price ceilings were held rigid while wages were boosted. The result was a series of price-wage squeezes which upset production. They would have been disastrous if we had not been in a sellers' market, created by a tremendous accumulation of wartime shortages. In 1947, however, many industries will be in a buyers' market. It must be possible, therefore, to have wege increases reflected promptly in price adjustments if we are to avoid a repetition of the costly post V-J Day round of strikes, which often had price control as the key issue.

3. Rapid decontrol is necessary to maintain a high level of employment and production.

> Almost five years of price control inevitably twisted the factors of production and distribution far out of the equilibrium which would prevail in a free economy to which it is the clear purpose of the nation to return. Unless the return to a free economy is facilitated by a speedy and orderly decontrol, the jolt of an abrupt return to competition can be expected to upset employment and production seriously.

It's Up To Business

To encourage speed end boldoess in decontrol, Congress provided for the reimposition of control over any prices which, after being released, might

get out of hand. The dangers of this sort are chronically exaggerated. During the 25-day period in July when there was no price control the Civilian Production Administration found that "manufacturers of finished industrial and consumer products have generally exhibited commendable restraint in increasing prices no more than increased costs."

All of this endeavor to speed up decontrol and expand its scope is likely to be futile, however, unless business furnishes the driving power for the machinery Congress provided. OPA certainly will not do it. Neither can the Decontrol Board be expected to go out and drum up cases.

The necessity for vigorous action by business in pressing for decontrol is increased by the fact that the general legislative standards to guide decisions by the Decontrol Board are vague. They must be clarified and sharpened by decisions in specific cases.

The main principle to guide the decontrol of non-agricultural products is that price ceilings shall be removed when supply is in approximate balance with demand. But what precisely does that mean? The meaning will become clear only through Decontrol Board decisions.

The same is true of the principle which makes automatic decontrol of a non-agricultural commodity contingent on whether or not it "is important to business costs or living costs." Business must press cases which will give specific meaning to those vague terms if decontrol is to get on apace.

Cards Are Stacked

At present the government has the cards pretty well stacked against rapid decontrol.

First, the key members of the staff of the Price Decontrol Board are holdovers from the Bowles regime which emphasized the importance of carrying on price control rather than speed in getting rid of it.

Second, in exercising his authority to prescribe regulations to govern petitions for decontrol, the OPA administrator has required excessively complicated statistical and economic data. Manufacturers who are sure they can convince any fair-minded board of the desirability of decontrolling certain of their products assert that they are blocked by statistical entanglements.

Third, OPA has discouraged business from moving immediately under one section of the law to speed decontrol. This section provides that products "not important in relation to business or living costs" may be freed from price ceilings immediately and must be freed by December 31, 1946, unles OPA specifically finds they are important to these costs. Instead of making it possible for business to move under this section now, OPA has issued rules which have the effect of blocking such a course until the end of the year.

In the light of obstacles such as these, it is not surprising that the record of decontrol to date is not impressive.

Decontrol Record

Since June 30 there has been a drop from about 70% to about 60% in the total value of products under price control. But most of the drop has been accounted for by food products, which Congress took the lead in decontrolling, and by industrial machinery which was being decontrolled when Congress acted. By far the larger part of manufactured consumer goods remains under control.

This, however, is no time for business to be discouraged. Rather, business should accept the obstacles put in its way as a challenge and work harder than ever for speedy decontrol.

The case for decontrol should not be stated in narrow technical terms. It should be based on grounds of broad public policy, and should demonstrate how a speedy return to a free economy can hasten the full release of the nation's productive power.

For example, there should be very clear demonstrations of how, in far too many cases, rigid price ceilings—(1) discourage production of key parts and materials by making such production relatively unprofitable, (2) create shortages of key parts and materials which tie up broad ranges of production or result in piling up lopsided inventories of partially completed goods, and (3) thus cut away the foundations of a stable economy and the prospects of steadily sustained employment.

There should be equally full demonstrations of the well known sequence from shortages to unrealistic price ceilings to black markets. Meat prices are rolled back, but the meat is rolled under the counter.

A free economy is worth fighting for. Liberty is preserved only by the constant struggle of those who believe in it. Neither the interests of the nation in a strong and well-balanced economy nor the interests of business itself will be served by drifting at this time. Now is the time for business to lead a strong offensive for speedy elimination of price control.

James H. McGraw, Jr.

President McGraw-Hill Publishing Company, Inc

THIS IS THE 51st OF A SERIES

Peace Through Realism

THE RUSSIAN ATTITUDE in international affairs has been most disturbing to all of us who are sincerely interested in world peace. Although it has shattered our dreams, history may prove that we owe a deep debt of gratitude to Russia for this unwilling plunge into realism.

We would be adopting the tactics of the ostrich if we closed our eyes to the possibility of war with Russia. Sound thinking demands that we consider the possibility of war with any nation or combination of nations. At present Russia is the nation best fitted to engage in such a conflict. We must consider this unpleasant possibility but we must not fear it. With a slightly higher caliber of common sense than that to which we are accustomed, we can avoid or indefinitely delay that or any other war.

What we should fear more than war, more than the Russian advantages in population and potential resources, is Russian realism and our lack of this important quality. But this very characteristic can be a point in favor of peace if we are willing to make it so. The Russians are far too practical a people to seek war with us as long as we are strong.

It is not mere coincidence that Japan struck out against us at almost the precise moment that the Allied aircraft production curve crossed that of our enemies. If our air power and other elements in our ability to make war had not been in an abominable state, we might easily have avoided the recent war. If the present Russian attitude arrests our headlong drive into disarmament we can thank them for a paradoxical contribution to world peace.

LET'S SUPPOSE for a moment that we were plunged into a war tonight. How long would it take to reorganize our air force? How long would it take to start aircraft production lines rolling again? Conversation with many thinking people indicate that they do not realize how long these things would take. They do not realize the true extent of our demobilization. But whether it means months or years is unimportant when we think in terms of the tempo of warfare waged in hours and in minutes.

In the pages of recorded history one theme recurs with dull monotony. It is the story of the empire or nation, softened by victory and often culture, which became easy prey for hardy aggressors. Few nations have ever looked on war with greater distaste than we. But we are still too young and vigorous to accept decline. The time has come for a reappraisal of the state of our air power in all of its basic elements.

The cost of increasing military aircraft procurement to a level where rapid expansion of facilities would be possible is slight compared with the cost of conducting another war. The apparent waste in the building of planes we may not need is not real waste because it bolsters our economy and provides an insurance factor against war. To provide for procurement at the proper level is the direct responsibility of the Congress.

OUR INDUSTRY can do its part by much more vigorous pursuit of the export market. Already we have lost the first lap in the race for Latin American business. It must not be forgotten that exports kept this industry in business right up to the last war. Without that prewar export business there would have been no industry to expand.

Neither can we afford to lose more time in the international race for supersonic aircraft. Our British Allies are pushing aircraft performance right into the teeth of the transonic range and, as this was written, had continued to keep the Gloster Meteor ahead by a few miles per hour. We were ready to explore the mysteries of transonic speed when the unfortunate loss of Jack Woolams in a racing plane accident set us back. Our assault on the sonic barrier must be carried on with as little loss of time as possible.

We have come out of the last war with a dangerous, carefree feeling that all urgency has passed. But the race against time to harness natural forces still goes on and always will. In the seven year sequence starting with research and passing through the development, design, production, evaluation, and tactical utilization of a military aircraft, there must be no delays. A setback anywhere along this line provides an opportunity for some other nation to come out first with a deadlier air weapon.

EDITOR

Putting Your Community On The Airmap

By GEORGE TENNEY, *Chairman Aviation Committee, San Francisco Chamber of Commerce*

Here's how an alert Chamber of Commerce coordinated aviation activities with excellent results for its area. The pattern can be used in any size city or town.

ANY ONE OR ALL of San Francisco's legion of airminded citizens will, at the drop of a hat, proudly tell you their city today is the center of the air world. They give every evidence of being determined to make their community a world terminus and the air capitol of the Pacific.

This might seem a strange attitude in a metropolis devoid to a large extent of aircraft industry, a city which accepts airlines as useful, but whose entire growth has stemmed from a wealth-producing harbor.

A large part of this area-wide enthusiasm can be traced, however, to one source—a source which can be developed in communities large and small throughout the country. That source is the city's Chamber of Commerce and its two-yr old Aviation Dept.

With community support the San Francisco Chamber under Gen Mgr Louis B. Lundborg, an astute young veteran of Chamber work, and its Board of Directors headed by Pres Brayton Wilbur, an aviation-conscious world trader, has pioneered in a field hitherto comparatively untouched by such civic organizations. This pioneering is paying off every day in solid achievement.

The role of a Chamber in contributing to development of aviation has, in the past, been the subject of somewhat conflicting opinion. Some rugged individualists in aviation have volubly resented any outside influence in their field. Others have recognized the need and the value of community support and have welcomed intelligent Chamber aviation activity.

The latter opinion apparently has begun to predominate and in many instances, the local Chamber is the first "port of call" for help in promoting aviation. However, only a few Chambers have been more than incidentally active in aviation. In 1944, when the San Francisco Chamber created its Aviation Dept., less than ten such organizations in the U. S. possessed an aviation department as an integral part of the staff organization. That number is now increasing daily.

San Francisco's Chamber has a long history of participation in aviation, dating back to the early '30's. It was not until October, 1944, however, that it centralized this activity in a staff department reporting directly to the General Manager and the Board of Directors.

It is, perhaps, significant that two yrs later, on June 14, 1946, the Los Angeles Chamber of Commerce, reputedly largest in the country in membership and income, announced separation of aviation functions from the Transportation Department and creation of an Aviation Department with a full time manager, assistant and staff.

Insuranceman Edward V. Mills spearheaded drive which got many different Bay Area groups working as team to advance aviation—and with it their own communities.

Back in 1944 the San Francisco Chamber's Aviation Dept. had no well defined path to follow, other than the application, to aviation, of Chamber techniques tried and proved in other activities traditional to Chambers of Commerce.

It was obvious that a Chamber of Commerce can't build airports, or factories to make airplanes. Neither can it set up schools to teach the fundamentals of aviation. It was just as obvious however, that a Chamber can and should play a vigorous role in stimulating the building of airports, construction of aircraft factories, and teaching of flying.

In line with this thinking, major objectives set by the Aviation Department and being carried out daily, included awakening of community interest in aviation and the inspiration of community action to solve aviation problems.

The Department embarked on a long range program to coordinate individual and civic energy directed toward making both the city and the 9-county San Francisco Bay Area the passenger, mail and cargo air terminal of the Pacific and an international "gateway" for global air traffic.

The new Aviation Dept., free of any hampering restrictions, was given considerable leeway and the opportunity to utilize all available facilities to achieve the objectives. Any Chamber, large or small, can do the same thing.

Can tangible results be achieved? Well, coincidence may have had a hand in it, but here's only part of the 2-yr record:

In Nov., 1945, San Francisco, a city noted for its reluctance to approve bond issues, passed by a 6 to 1 majority a $20,000,000 bond issue to modernize its Municipal Airport and make it one of the world's greatest.

United Air Lines selected that airport as its system-wide repair and maintenance base. Pan American decided to expand its Pacific-Alaska Div. headquarters based at the airport. Slick Airways, Inc., largest of the non-scheduled freight carriers, established a base; Pacific Airlines, an intrastate carrier, decided the time was ripe to start service out of San Francisco. Southwest Airways, Inc., just granted a West Coast feederline route, decided to base its 250 employes at San Francisco.

Shortly after the Chamber's Aviation Dept. launched a drive for appointment of a West Coast man to the CAB to fill an existing vacancy, Col Clarence M. Young, a San Franciscan, was chosen for the post.

When the veterans began coming home, a Veterans' Aviation Job Counselling Panel, set up under Aviation Dept. guidance, started a program which has since given counsel to hundreds of discharged service men and women.

Under Chamber stimulation, the San Francisco City Planning Commission began work on development of a survey designed to produce a centralized joint airline transportation terminal. Through the same type of leadership there was organized "from scratch" a Bay Area Chapter of the National Aeronautic Association, now growing into what promises to become the largest Chapter in the country.

Kenneth R. MacDonald, a 34-yr old red head who set up the Aviation Dept., acts as Secretary to the Chamber's Aviation Committee, of which the writer happens to be Chairman; as Secretary-Treasurer of the Bay Area Aviation Committee; as Vice President of the Bay Area Chapter of NAA, and as a member of the Board of Directors of the Western Aviation Conference. In addition, with his Secretary, Miss Helen Ellis, he runs the Chamber's Aviation Dept.

With a background of newspaper, public relations, organizational and aviation experience, MacDonald has made rapid progress in convincing San Francisco leaders that aviation has become a vital economic and social influence, as well as one of our fastest growing and most important new industries. He daily practices and preaches the doctrine of adequate and timely aviation planning, of fulfilling community responsibilities in assisting in the growth of a new industry which can, in years to come, change our entire way of life.

As an example of the service which can be rendered by such a Chamber department, as soon as President Truman signed the Federal Airport Aid Act, MacDonald began making arrangements for a mass meeting of area Chamber, city and county government officials for a discussion with CAA executives of the procedures necessary to qualify under the new law.

As a result, J. S. Marriott, 6th Regional CAA Administrator, and R. W. F. Schmidt, CAA Regional Airport Superintendent, flew to San Francisco from Los Angeles for the first public review of CAA plans, procedures and regulations before 92 city, county and Chamber officials anxious for first hand information on Federal Airport aid.

A Chamber planning establishment of an aviation department should, as the San Francisco Chamber does, bring into its orbit community leaders willing to devote time and energy to an aviation committee which can develop policy and carry out specific responsibilities.

San Francisco's Aviation Committee has 21 members and includes representatives of airlines, although the airlines are in a minority on the Committee. This is desirable to maintain an unbiased approach and to avert any accusation of domination by a single group.

Committee decisions are reached only after full discussion and the members are encouraged to speak freely. Outsiders, if they should be called that, are invited to attend Committee meetings and give the benefit of their information or experience, but the actual decision on any subject is restricted to Committee members, who are appointed each year by the Chamber's President, and who meet on call of the Chairman.

In addition to handling details of Committee activity, MacDonald also is responsible for all Chamber participation in such complex activities as development of airport plans, stimulation of air education, location of aircraft manufacturing facilities, development of factual data on air traffic and countless other activities.

Under the heading of general aviation services, MacDonald maintains a comprehensive, indexed library of books, magazines and pamphlets on aviation, available on a loan basis to organizations and to individuals. The library's pamphlet service includes over 500 documents covering such diverse subjects as copies of CAB decisions to aviation legislation of the various states and speeches on aviation.

A word of warning though—an adequate library, much of which can be obtained without charge from varying

Widely divergent interests of these nine central California counties were successfully coordinated into one basic aviation program by San Francisco Chamber of Commerce's Aviation Committee. How program was designed—and how it can work in other towns—is told in accompanying article by the committee's chairman.

sources, will in time crowd the average Chamber of Commerce "out of house and home" unless forethought is used.

The San Francisco Chamber hopes to see a centralized, specialized library on aviation, adequately housed and available to the entire community. Meanwhile, it has worked out arrangements whereby Pan American Airways' library is utilized for the Chamber's overflow material.

An additional important part of the Aviation Dept.'s service is its magazine file of 19 aviation magazines available for reference or just plain reading.

The department has also set up a clearing house for data on aviation. Although no record is kept, not a day goes by without innumerable requests by telephone or personal visit from people who want to know "how far is it by air to New Caledonia" or "what reason did the CAB give for turning down Western's application to fly to Seattle." All requests are answered either at once or as soon as the information can be obtained. The data desired, by the way, is obtained by the department to avoid passing the call to other sources. This policy, over a long period of time, will not only help to create friends but will also assure the Chamber's place in the community as the authoritative source of aviation information.

The department maintains an active Aviation Speakers' Bureau, which furnishes speakers on aviation to local organizations such as Kiwanis, Rotary, etc. Up to date directories of aviation plants, airlines, schools, airports and other aviation source material are in constant use.

Perhaps the most successful of the department's innovations is the weekly Aviation Newsletter, now distributed to more than 600 recipients throughout the United States. The "core" of the mailing list is the Chamber's Aviation Committee and local aviation enthusiasts. Requests for copies from as far distant as Honolulu and England, and other states have boosted distribution.

The Newsletter is intended to keep its readers up to date with "capsule" reviews of aviation news and developments locally, in the State, the West and the rest of the world. To prepare the Newsletter MacDonald reads all the magazines in the department, keeps abreast of all developments insofar as it's possible and devotes one morning a week to its writing. It is mimeographed on a special heading and goes out each Friday via second class mail. In terms of cash expenditures, the Newsletter is perhaps the department's most expensive project.

The budget for such a department is a subject almost too complicated to review because of the wide variations in Chamber size, membership, income and activities. There are practically no comparative methods of presentation which can be applied to all Chambers. Perhaps the best advice is to "trim the budget to fit the purse and the aims to be achieved."

One major departure from traditional Chamber of Commerce "my city first, last and always" thinking, has been the attitude of the San Francisco organization toward area-wide aviation unity in a geographic situation where literally dozens of communities vie with each other for prestige and advancement.

This attitude has been particularly noteworthy in aviation and the San Francisco Chamber has contributed without stint in time, money and effort toward organization of a cohesive, area-wide cooperative aviation group which could eliminate such a philosophy.

In May, 1943, the Chamber began to convert its then strictly-local Aviation Committee into such an area group. Working with Edward V. Mills, Controller-Treasurer of the Fireman's Fund Insurance Co., and an outstanding exponent of area unity, the group was expanded to take in other cities in the area.

When the Aviation Dept. was created, the services of MacDonald and facilities of the Department were then given over to the area group and its name was formally changed to Bay Area Aviation Committee, with written organizational procedures and a vastly enlarged membership.

Establishment of this Committee marked a major turning point in the development of aviation throughout the region. Leaders in the group realized the inherent danger of each of the nine Bay Area counties carrying on a tug of war, with each group pushing and pulling for its own localized community ends.

Mills and MacDonald convinced aviation groups in each county that a Bay Area Committee, giving each city and group equal representation, could be of genuine service as spokesman to the world on aviation, and as a consultative body for its membership.

Kenneth R. MacDonald sparkplug of San Francisco Chamber's Aviation Dept., also serves as secretary-treasurer of Bay Area Aviation Committee—the cooperative group—and also is director of Western Aviation Conference.

The Committee now is a volunteer coordinating agency available as aviation consultant and service organization to the entire Bay Area, including those individual groups which support it and which maintain representatives in its ranks.

Members are authorities on finance, traffic, manufacturing, legislation, public relations. Its sphere of representation extends the length of the San Francisco Peninsula, to San Jose, as far into the North Bay as Santa Rosa, 50 mi. away, and into the East Bay as far as Pittsburg, some 40 mi. distant, representing a population of more than 1,600,000 people.

Represented on the Committee are 23 Chambers of Commerce, 7 Junior Chambers of Commerce, 5 operating commercial airlines, the administration of 4 major Bay Area cities, 7 aviation trade associations, the air branches of the Army and Navy, and individuals.

Policy is determined by an Executive Group which consists of the Chairman of each permanent Advisory Group, (there are eight), and the Chairman and the two Vice Chairmen of the entire Committee. Each Advisory Group thus shares in policy establishment.

Each member organization is entitled to appoint one regular representative and one alternate. The alternate may participate in all activities but may not vote except in the absence of the regular representative. Officers are elected each year by the members and expenses are paid by a membership fee based on population, which ranges from $15 per yr. for the Chamber serving the smallest community, up to the $100 a yr. which the San Francisco Chamber pays.

At present there are 18 individual members, 48 organizational members and 40 alternates, a total of 106. Each organization has an equal voice in Committee decisions and there is no possibility of any one group or combination dominating.

Divisions of Work

MacDonald serves as Secretary-Treasurer to the Bay Area Aviation Committee, handles all of the detail of its work and has sparkplugged its growth and activity.

Committee work is assigned to its Advisory Groups, which are: Airports, Aviation Industries, Legislative, Public Relations, East Bay, Executive, North Bay and Peninsula. These Groups are responsible to the overall Committee for aviation planning and development in each specific field covered by their assignment.

Advisory Groups operate with complete freedom of action in their respective fields and may originate activity, as well as carry out Committee assignments. Members are appointed to the Advisory Groups by the Chairman on the basis of their qualifications for a particular responsibility.

As an example of Group activities, the Airports Advisory Group is responsible for assembling data on types of landing facilities required and for stimulation of master airport planning. It has been sometimes embarrassingly persistent in "prodding" city and county government officials into planning action.

The Aviation Industries Advisory Group, as another example, explores the area need for plant facilities for manufacturing, working with and through local Chambers in each community, leaving to the local community direct contact and negotiations for establishment of plants. Special Study Groups are appointed as needs arise and are disbanded on conclusion of their assignment.

The Committee may, when it considers such action desirable, make recommendations to its constituent organizations and, conversely, any member organization may, through its representative, ask for Committee study, action and assistance.

The Committee does not, however, commit its constituent organization members to its policies or actions. Policy is established and action is undertaken only in the name of the Committee as an independent Bay Area coordinating group.

West Coast Case

An example is the Committee's attitude toward the recent CAB decision in the West Coast Case, which denied Western Air Lines a route from San Francisco to the Pacific Northwest and denied American Airlines entry into San Francisco. The Committee appointed a Special Study Group to review the decision.

The airlines involved presented their points of view and the Study Board, after careful review of the entire case, recommended that the Committee refrain from taking any action leading to possible reconsideration of the decision on the basis that there was danger that such reconsideration might result in reopening of the entire case and delay start of feeder-line services which the Board had authorized.

This became the official position of the Bay Area Aviation Committee and its members were free to accept or reject that position when developing a policy of their own. The Oakland Chamber and several others, although members of the Committee, nevertheless asked CAB to reconsider its decision.

"It's right and proper for these members to take such action, despite our Committee's recommendation," Chairman Mills explains. "The purpose of the Committee is to obtain and review all the facts, make its recommendations and carry through as an area wide group, but not to impose its recommendations upon individual members.

"The principle objective of this Committee is to develop cooperation and unity in our effort to promote the growth of aviation. When our advice and counsel is accepted, we're pleased, of course, but we cannot develop unity by dictating the attitudes of others."

Achievements of the Committee have been notable, if in no other field than in development of this unity. San Francisco newspapers and other local publications have commented editorially that ". . . perhaps the most significant evidence of round-the-bay unity yet developed is the Bay Area Aviation Committee."

The city administration delayed presentation to San Francisco voters of the $20,000,000 airport bond issue pending a study by the Bay Area Aviation Committee which produced a thoroughly documented report endorsing the project.

Mayor Roger Lapham chose Mills and Marsden S. Blois, San Francisco banker and Vice Chairman of the Committee, to head the Citizens Airport Bond Committee, the group which led the successful drive to put over the bond issue. Mills and Blois both received leaves of absence from the Committee in order to handle the airport bond drive.

The Committee devoted considerable time and effort during the recent sessions of the state legislature to organizing the state's aviation interests into a campaign to defeat legislation considered adverse to aviation and to enact laws which would help development of aviation.

Committee studies of technical advances, traffic development, financing problems, expansion of manufacturing and service facilities and other similar projects give to Bay Area communities and groups sound factual data on which they may base constructive, localized aviation planning.

San Francisco—both the city and the 9-county Bay Area—thus have two practical, working aviation organizations, one to serve the aviation needs of the city itself, the other to meet aviation needs created by a special set of geographic circumstances.

Costs are simply those of personnel and organizational time. Any community or area in the United States can, and should, do as San Francisco did in organizing these two groups. The cost is low compared to the results which can be achieved.

No Chamber of Commerce is too large to evade its responsibilities in aviation; none is too small to excuse its failure to do the job on the basis of costs. As stated before, the budget can be "trimmed to fit the purse" and if there is no budget at all, any one of a dozen or more aviation groups such as local fixed base operators, airport owners, or simply private flyers, could be the guiding light, both morally and financially, in getting their Chamber to launch and maintain such a progressive program.

Selling In The Export Market

By RAYMOND L. HOADLEY, *Financial Editor, "Aviation"*

The rules for those who want to enter this field—or who aren't now having any luck—are simple, but they're as important as the product.

Example of British efforts to capture export markets is this "flying showcase" full of Empire products in Bristol 175 Freighter now on tour of 25 major U. S. cities as prelude to extended visit to 15 Central and South American countries. (Aviation photo)

It's a difficult thing to run an export business from a desk in New York or Los Angeles. American aircraft and parts manufacturers already are losing plenty of postwar business abroad because of the slipshod way they are drifting into foreign trade.

There's the chance, for example that the aviation industry may find within the next five years that Britain has sewed up the lion's share of the attractive Latin American trade. If so, it won't be because they have superior products to offer. It will simply be because the English have been experienced foreign traders for generations and have learned a lot more export "know-how" than we have.

One American exporter recently made a shipment of $4,000 worth of umbrellas to Paita, Peru, not realizing that it hadn't rained there in 40 yr. Aircraft makers aren't likely to pull any boners like that, but they are making mistakes that are likely to give them a bad reputation with Latin American customers. There are many wrinkles in the export trade that don't crop up when dealing with home markets.

It's always a good idea to visit the Latin American market you are interested in, providing you have a working knowledge of the language or can hire an interpreter who knows the technicalities of your product. Don't go unless you think you will like Latin Americans and don't plan on a hurried look-see trip. The people south of the Rio Grande are very proud and sensitive. They have an active distaste for American "hurry-up."

S. J. (Speck) Roll, foreign trade councillor of Pan American Airways Corp., has ten commandments for conduct in Latin America. They are worth repeating:

1. Don't refer to yourself as "Pan American". They also are Americans and resent our preempting the term.

2. Know something of the history and background of the countries you visit.

3. Don't jump to the conclusion that all Latin America likes bull fighting. Some countries heartily disapprove.

4. They take their religion seriously. Respect it.

5. Don't boast. They have many things both material and cultural of which we could be justly proud.

6. Respect their language.

7. Respect both their local customs and their dress.

8. Don't criticize. There's plenty they can criticize about us.

9. Don't make a scene. You may be wrong, because you haven't fully understood the language.

10. Above all be courteous. In general, they have more leisure than we do and place special value on courtesy.

Maybe you can't speak Spanish or Portugese, but you can realize that Latin Americans who speak English sometimes use words which have been literally translated and do not mean to them what they mean to you. A friend of the writer's recently had a visitor from abroad who kept saying, "I shall be your representative", whereas what he meant to say was, "I would like to be your representative."

The first step for any aircraft concern going into the export business obviously is to pick good men to handle the foreign end of the business, whether they be export managers, branch managers or foreign representatives. Travel, of course, is an absolute essential to the proper conduct of exporting. It was very necessary for the export manager to travel before the war and that consumed a lot of time. It's even more necessary now but will take less time thanks to the airline facilities now available.

Most aviation concerns probably are selling abroad through sales representatives rather than through their own branches. There are advantages in using this method for the average exporter in that he has no overhead, assuming that he pays a commission rather than a salary. Also he is not so likely to run up against the anti-foreign feeling if the sales representative is a Latin American citizen.

Nor does he usually become involved in foreign taxation.

But in the case of either sales representatives or branch offices the exporter can be supplied with market surveys, tariff and import control information and kept generally informed on industrial, financial and political trends in the market.

There is no one answer to the problem of securing suitable foreign sales representatives. It often is best to visit the market in question, but agents can be obtained through correspondence or advertising. The best bet probably would be to hire a North American who has set up in business in Latin America. He would naturally be more inclined to push products from this country than from England and probably would better understand your viewpoint and business methods. As a general rule it's not wise to hire a European to sell a North American product.

Some of the best representatives are found through friends handling similar not non-competitive products. Then, of course, banking connections often are helpful in securing agents. The trade magazines, trade association bulletins and the Department of Commerce publications have current lists of firms and individuals abroad seeking import connections.

You will find that many of those who ask for exclusive representation of your product will take on anything from safety pins to bulldozers. Some agents take on more dissimilar products than they can handle adequately. And sometimes representatives are given too much territory to cover. A firm may be very strong in Rio or in Sao Paulo, or both, but may not have the proper connection in other Brazilian cities. In some countries there is great jealousy, even between cities, so that it might be somewhat difficult for a representative in one city to sell goods in another unless he has a branch there.

Latin American politics being what they are it is well to avoid a representative who is too prominent politically. He may very well be prominent politically when you make the arrangement but may be exiled before any business results.

Try to get your representative to devote the bulk of his time to your line. Make sure he is not representing competitive products as well. There are cases where a representative has asked for a line for the purpose of keeping it out of the market rather than to sell it.

Most experienced exporters advocate payment of commissions rather than straight salary. But pay as large a commission as the business will stand, otherwise your representative may be found drifting to more profitable goods. Commissions should be made payable when you receive payment for the goods. This will tend to make your representative investigate carefully the buyer's financial condition.

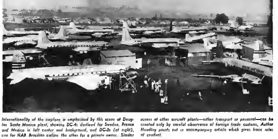
Your representative should receive copies of all invoices for your products shipped into his market and he usually is entitled to a commission on such shipments whether he actually sent in the order or not. Some importers like to deal direct with the exporter and place their orders through their own agents or commission houses in New York. But the representative is entitled to his commission just the same.

Beware of any propositions for goods on consignment. Representatives usually devote their selling efforts to goods for which they have to pay. It's up to the importer or the distributor to arrange for the sale and distribution in the foreign market.

And finally, in corresponding with Latin Americans it is well to write in "pure" English. Its well to bear in mind that they may well be unacquainted with our commonest idioms or our slang. The foreigner is a stickler for the usual formalities in the opening and closing lines of a letter. But he also responds to a few intimacies despite his tendency toward formality. A reference to a national holiday or some significant occurrence in his country helps indicate a real interest.

Do not expect a literal translation of such coined words as "know-how" and don't use incomplete words, such as 'head' for 'tool-head'. Try to avoid that common North American fault of using long sequences of modifiers and use only abbreviations that can be found in any standard dictionary.

Such rules of conduct may sound too elementary to bother with. They are elementary, but they are absolutely essential, as every successful foreign trader knows. And since they are so essential, it is vitally important they be followed closely by those who are attempting to break into the foreign trade field, or by those who have not yet been able to successfully compete in this lucrative type of business.



Internationality of the airplane is emphasized by this scene at Douglas Santa Monica plant, showing DC-4s destined for Sweden, France and Mexico in left center and background, and DC-3s (at right), one for NAB Brazilian airline the other for a private owner. Similar scenes at other aircraft plants—either transport or personal—can be created only by careful observance of foreign trade customs, Author Hoadley points out in accompanying article which gives basic rules of conduct.

Aircrew Evaluation Plan Means More Bomb Hits

By **COL. WILLIAM H. BLANCHARD**, *Commanding Officer, 509th Composite Group (58th Wing), AAF*

and **SCHOLER BANGS**, *"Aviation" Correspondent Attached to Kwajalein Air Base*

An important dividend of the great Bikini experiment is already one of our AAF's prized possessions—a system of mathematical surety for judging A-bomb crews, necessary in selecting top teams for bullseye delivery of this most lethal weapon.

Insignia of 509th Composite Group (58th Wing), depicting participation in Crossroads experiment

Dropping 77 facsimile practise competition bombs prior to release of a genuine atomic bomb at Bikini led to introduction of several new factors in the selection of bombing crews.

To a large degree success of the first of Operation Crossroads' three atomic bomb tests depended upon the aircrew chosen to drop the bomb.

It was necessary for those directing air participation to be sure of the selection of the most competent bombing team obtainable, and to be able to support that certainty by conclusive evidence of ability. A bombing competition with atomic bomb facsimiles was decided upon.

Scoring of results presented problems not encountered previously, and presented a variety of influences upon scoring techniques.

These were taken into consideration as practise bombing progressed and were finally expressed thus: S = CEPB × NB/TA.

S represents a team's final score, CEPB the Circular Error Probability at Bikini, or the percentage expression of a team's chances of landing an atomic bomb within a radius of 500 ft. from Bikini target center; NB the Normal Bombs credited to a team during its contest participation; and TA a team's Total Attempts in contest bombing.

In application, the formula would give a score of 68% to a team which possessed a CEPB of 91% and had dropped 9 normal bombs in 12 attempts—.91 × 9/12 = .68 Score.

Investigation of the determining factors of the equation will show the complexity of their evolution and the merit of going considerably afield from the simple rating of hits and misses in selecting a bombing team which can be judged as best.

During early stages of the competition there was close adherence to scoring techniques stemming from rough-and-ready evaluation of wartime bombing, which did not envision the need of placing a single bomb within 500 ft. of a target within a specific few seconds on a given day.

However, a question soon arose to assail simple scoring with influences seldom, if ever, considered in a bombing competition.

Those evaluating practise bombing became concerned not so much with the merit of a practise bombing mission at Albuquerque as with deciding the question:

"How successful would this mission have been if it were the actual A-Bomb drop?"

Probing such a question was to lead, finally, to acceptance of new scoring criteria and employment of a group of mathematical experts headed by Dr Mark Eudey of University of California, former operations analyst for the 9th Air Force and, later, 2nd Air Force.

As a foundation for scoring standards, explicit requirements of the atomic bomb drop at Bikini were declared:

1. The A-Bomb must be dropped within 500 ft. of target center;

2. A tone signal must be sent from the bomber and stopped at the instant of the bomb's release to provide absolute coordination of measuring devices and cameras set for actuation within seconds before detonation;

3. To coordinate the movement and preparedness of all air and surface units taking part in the test, the copilot must give an understandable and accurate radio commentary on the progress of the "dry" and "live" bomb runs;

4. Prescribed values of altitude and axis of attack must be adhered to thoroughly by the bomber.

It will be apparent from the foregoing that optimum cooperation would be indicated for the winning team. Also, failure to meet any one of the four requirements in a practise drop would indicate an unsuccessful result if it were the A-Bomb mission.

As a basis for classification and adjustment of scores, all practise bomb releases and attempts at releases were placed in three groups. Normal aimings, non-normal aimings and gross errors, and disqualified bombs.

After careful consideration, certain rules were laid down to determine what practise missions should be marked as other than normal aimings.

Any preventable error which led to the bad placement of a bomb, and which later could be traced to the person or persons responsible, was listed as a gross error.

To determine whether a bomb should be considered the result either of a non-normal aiming or gross error, recourse was made to the assumption that bombs falling close to the aiming point follow a normal, or Gaussian, distribution, and that superimposed upon this distribution is another of much greater variability which includes all bombs falling a relatively long distance from the aiming point.

Where bombs fell outside the Gaussian distribution circle for some unknown reason, they were listed as non-normal aimings (rather than gross errors), if they fell beyond a distance determined by a rule used to decide a questionable drop.

A mean circular error probable for all qualified bombs was computed and multiplication of this figure by 2.08 gave an error limit beyond which only one out of twenty normal errors might be expected. Any errors exceeding this limit were considered non-normal and were included with gross errors in future computations.

Drops made at Albuquerque from uncalibrated aircraft were disqualified. Observed wobbling of a released bomb would disqualify the mission.

In early practise runs during which the target was obscured by clouds at the time of release or for all but the last 40 sec. or less of the run, a disqualification was allowed. However, after May 27, if the crew elected to make a drop when it was optional to either return or jettison the bomb, the release was counted regardless of visibility over the target.

While disqualified attempts were relieved from measurement of the distance of miss (where bombs actually were dropped) they nevertheless were a consideration in giving the Normal Bombs and Total Attempts factors of the scoring formula.

After eliminating disqualified bombs, those considered to be qualified—both normal aimings and those rated either as non-normal or influenced by gross error—were subjected to rating adjustments for an additional three factors:

1. Reducing results of practise bombing at varying altitudes to results for a common absolute altitude, using AAF conversion factors;

2. Correction of inaccuracies in bombing tables provided competing bombardiers. A systematic range error of plus 80 ft. was subtracted from range measurement of each bomb hit on the Albuquerque range. Bikini bombing tables provided for an air burst above the target, giving an "over" on impact which was subtracted from range errors of certain Albuquerque and Bikini practise drops. At Kwajalein, Bikini tables were provided for high explosive bombs instead of A-bomb facsimiles, and the range difference between tables was applied to scored range errors;

3. Adjustment of scores for deviations of weights of practise facsimile bombs from the atomic bomb for which bombing tables were computed.

Separate consideration then was given for bombs dropped at Albuquerque and Bikini, and qualified bombs of each bombardier were divided into two classes. In one group were bombs which seemed to fall within limits of normal probability distribution. In the other were bombs which exceeded those limits.

Generally, aside from altitude considerations, bombing conditions at Albuquerque were better than those at Bikini, and as the close of competition approached a weighting factor was injected into score computations.

This factor was derived from the ratio of errors of all normal bombs dropped at Albuquerque to all normal bombs dropped at Bikini.

The factor was applied to bombs dropped at Albuquerque to bring them into equality with bombs dropped at Bikini, the final score considering the combined list of bombs dropped in both areas.

Final score for each crew was calculated to represent the percentage of missions that might be considered from the bombardier's standpoint as successful "A Day" (Ultimate atomic bomb drop at Bikini July 1) missions.

Resolution of the foregoing influences and corrections into the elements of the scoring formula (S = CEPB × NB/TA) finally made available a trustworthy estimate of which one of the four competing crews would have the highest chance of successful performance of "A Day".

Determination of the CEPB for scoring purposes presented difficulties, the solution of which was Dr. Eudey's responsibility. Without attempting to go into details of his calculus, it will be sufficient to cite here a supporting formula used to reach a CEPB figure.

A Circular Error Probability was formulated as an expression of the root-mean-square estimate of the average circular error (radiant distance from target center) in normal aimings. By calculus, embracing practise bombing at Bikini, this CEP was converted into a percentage expression of proba-

Col. William H. Blanchard co-author of this article, and commander of 509th Composite Group which dropped Able-Day bomb at Bikini. His group now is at Roswell, N. M., organizing a general AAF atomic bomb training program.

bility of a bomb hitting within 500 ft of the target.

A complete example of development of a final score for a team can be given as follows:

Albuquerque CEP	242 ft
Albuquerque CEP converted to Bikini (x 1.20)	290 ft.
Bikini CEP	236 ft.
Gross errors	1
Non normal aimings	2
Normal aimings	9
Normal aimings (%)	75
CEPB (%)	91
Score (.91 x 9/12)	68

As a check upon the application of mathematical scores given bomb crews a separate evaluation of crew personnel was conducted in the practise period.

Team evaluations gained by observation of the behavior of personnel, though they paralleled mathematical bombing scores, were not incorporated in the crew selection formula, but were submitted as supporting data. This phase of evaluation is sufficiently important to touch briefly upon the technique employed.

Primary consideration was given to air crew procedure as applied directly to the preparation and execution of a bombing run. The assumption was held that the team scoring highest in air crew procedure would be the one least likely to commit gross errors.

Staff officers rating crews for individual and team evaluation flew with the competing teams and issued final scores on the following points:

1. Radar operator's follow-through on the bombing run by use of the AN/APQ-23 radar bombing set,

2. Reciprocal check by navigator and radar observer of preset wind data; check of dry-run results by navigator, and report to bombardier by navigator of drift and ground speed on any heading differing from heading used on dry run;

3. Complete check-off of bombardier's switches by bombardier to another designated crew member;

4. Immediate advice to bombardier (by navigator or other designated crew member) of deviations from indicated airspeed and indicated altitude planned for the run.

5. Maintenance of procedure consistency, to the end that no team member at any time is in doubt concerning the actions of another member,

6. Execution of procedures in a manner indicating a high order of discipline and cooperation—vital in carrying out complex operations plans subject to frequent changes,

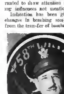
7. Use of all practicable checks on data used in sending true signals keyed to the operation;

8. Crystallization of crew procedure to afford ready transposition to other crews.

In personnel evaluation heaviest weight was given to behavior of the bombing team as a group, and separate reports were provided by two AAF Colonels, two Lieutenant Colonels and one Major who rode as check pilots.

Supplementary personnel ratings by operational specialists were provided concerning ground school records, the navigating team, radar team, communications, and flight engineering.

A final return to consideration of mathematical bomb scoring is warranted to draw attention to two scoring influences not mentioned before. Indication has been given of the changes in bombing scores resulting from the transfer of bombing to Bikini



Brig. Gen. Roger M. Ramey, who, as commanding officer of the 58th Wing, directed complex AAF participation in Operation Crossroads.

from Albuquerque, that bombing at Bikini was appreciably more difficult.

At Albuquerque competing teams had the benefit of both steady winds at all altitudes (minimizing ballistic wind computations) and visible ground check points for lining up bombing runs.

Bikini, on the other hand, presented complicated problems of ballistic wind correction and navigation. Because of increased cloudiness in the Bikini area as well as the paucity of ground check points, bombing crews were called upon to accomplish little short of miracles of navigation, using largely high-precision dead reckoning and radar.

Winds aloft, it was discovered, were unpredictable and changing constantly with altitude. A 25-knot wind blowing from 45 deg at 5,000 ft might be 35 knots 60 deg at 15,000 ft., 30 knots 55 deg at 20,000 ft., 30 knots 60 deg at 25,000 ft., and then 25 knots 270 deg at 30,000 ft.

It may be correctly assumed, therefore, that the bombing team which equaled or exceeded at Bikini its Albuquerque scores should be credited for its demonstration of navigation and bomb drop computation. It was considered reasonable and fair that scoring improvements at Bikini should be used to raise previous results in Albuquerque bombing.

Most corrections made in the rating of bombs dropped affected errors in range—an "over" or "short" function—and did not improve appreciably deflection errors to the right or left of the axis of bombing run.

Therefore, a crew with no deflection errors could be expected to gain rapidly in final scoring at the end of the practise bombing, when new tables, revised under the influence of bombing experience, were applied to correct the actual plot of bomb hits.

Maj. Swancutt's team's ability to place their bombs consistently with little deflection error helped to boost them from an insecure position in the contests to final holder of the top score.

Obviously, the Operation Crossroads bombing competition introduced considerations that would not apply to the training of crews for combat delivery of an atomic bomb over an area which permitted little or no practising.

But it is foreseeable that scoring techniques developed for the Bikini competition will prove useful in selection of the most competent bomb crews for the AAF's new very-heavy long-range bombers now under development.

It is certain that if we ever send aircraft out with atomic bombs to strike an enemy's nerve centers it will be a decisive engagement.

Ten or twenty bombs might win a war—if delivered properly, or lose one if they missed their specific targets. Our bombers very probably would have no alternate targets. All the bombing problems presented by Operation Crossroads would be in that mission.

Behind every crew member would be months of preparedness training such as that which led to the dropping of the Bikini A-Bomb.

To each would be given the ultimate in demand for high-precision performance—to the pilot in holding the bomber to an unvarying approach course; to the navigator and radar operator in locating the target and giving the bombardier precise meteorological information for final bombsight adjustments, to the flight engineer in maintaining unvarying power settings; and to the bombardier in timing the last split-seconds ending in "Bombs away!"

Never before in peacetime has the way of air preparedness been so brightly marked as by the flash of the first Bikini bomb.

Oil Company Aid For The Airport Operator

By R. R. BRINE

There's plenty of sales and service help, but outright financing calls for more than the asking. Here's why.

The Federal Airport Act passed last May making possible construction of some 3,000 new airports and enlarging of 1,600 existing fields may mean to private flying what a system of national highways meant to the automobile industry 40 yr. ago.

Such is the opinion of aviation experts in the oil industry. Therefore, each major oil company is conducting a program designed to make its product the favorite at the airports scheduled for construction under the $500,000,000 federal grant. These programs have long been in the making. Now, since the government has made its commitment, the oil companies' plans have become more clearly defined.

"It is too early to draw many conclusions. Abnormal conditions both in manufacturing of light aircraft and in airport construction cloud the picture," one oil company executive pointed out, "but certain patterns in the oil companies' merchandising programs are already apparent."

In general, the oil industry's program embraces three basic points of aid to airport operators.

Point one involves financing oil and gas dispensing equipment (including underground tanks, pumps, and mobile gas dispensing units) and, in special cases, underwriting other airport facilities.

Point two includes launching an extensive public relations program to promote private flying as a whole.

Point three contains the oil industry's plans for giving individual airport operators full advice on their advertising, merchandising, accounting, financing and equipment problems.

It has become clear that oil companies do not want to underwrite private airports or to completely finance hangar facilities on the new government-financed airports.

The type of operation which Gulf undertook last year in backing North American Airport Corp.'s $900,000 project at Westchester (N. Y.) County Airport is not now likely to be duplicated often in the future.

Yet every day people are coming to the oil companies to solicit their aid in getting into the aviation business.

"Many applicants look at the oil companies and think 'there's gold in them thar hills,'" according to Ralph J. Hall, assistant manager of the Aviation Div., the Texas Co.

These applicants are anxious to have an oil company back their operations in exchange for an agreement to handle that company's brand of petroleum products. Most of these men know little about sales potentials for petroleum products in their area, but expect the oil companies to build $20,000 to $50,000 hangars and set them up in business. Obviously they have an exaggerated idea of what an oil company can and will do for them.

R. C. Oertel, manager of the aviation sales department of Standard Oil Co. (N. J.), explained that "although we will finance sound deals, so will a bank—and we would much prefer that our oil dealers go to banks directly instead of to us. We have no desire to get into the banking business or the airport business. We want to confine our activities to the oil business."

This point of view is currently shared by all executives of major oil producers and distributors.

Nevertheless, where the business sales potential justifies it and the security offered by the marketer is adequate, oil companies may partially back a hangar project. A sales circular distributed by Standard of New Jersey says in part, "The business assistance plan of our company faces the fact that many small business men have not come through the war with financial reserves equal to their sound business expansion needs and that veterans may require assistance in starting a new business. To applicants of good character who demonstrate an aptitude for the airport business and who propose locating where success may be reasonably expected, the Esso Marketers contemplate making financial assistance available. This plan will supplement the service of local commercial banks in lending money to see these men 'over the hump' of post-war needs."

It should not be too difficult for able airport petroleum marketers to get an oil company to back them in construction of small buildings directly involved in dispensing petroleum products. It was in this way that garage and service stations were financed in the early days of the automobile business.

But the fact that only a small part of the airport operator's sales potential (10 to 20%) lies in the sale of petroleum products, as against 95% in the case of auto service stations, will make a tremendous difference in the extent of the financing that oil companies can be expected to do for the airport operator.

For these reasons, current aviation programs of oil companies stress their promotional and merchandising plans rather than financial aid. And a review of the oil companies' wartime promotion program reveals their ability to promote favorable public attitudes towards private aviation.

During the war when the oil companies had little to sell the consumer but ideas, many companies instituted long-range educational programs designed to help interested civic groups plan, select sites and establish suitable airport facilities for the various communities.

Oil company representatives cooperated in talks and discussions with the CAA. City and county airport planning councils, Rotary, Kiwanis and other groups obtained free advice from

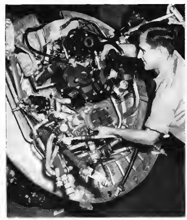
(*Turn to page* 138)

Engine Conversion Line Is New Base Activity

Southwest Airmotive's maintenance base features fast remodeling techniques to achieve three-day period for readying military plane power plants for civil use.

PRODUCTION LINE for changeover of aircraft engines from military to commercial standards is the focal point for a thriving new phase of business at Southwest Airmotive Co's base at Love Field, Dallas.

With work orders from a number of airlines and feeder organizations, SAC has devised a rapid, economical—and original—system for converting P&W 1830-43s, purchased as surplus off Convair B-24 Liberators, to 1830-67s and 1830-92s suitable for use in Douglas C-47s and DC-3s.



Simplified fuel line extending from pump to carburetor is fitted to 1830-92 engine by Ernie Hansen conversion program chief

Received complete with B-24 nacelles, engines are removed from mountings, and exhaust nipples are taken from cylinder heads to permit installation of C-47 exhaust collector rings. All electrical conduits and leads are re-routed, and new lines—vacuum, fuel, and drain—are installed. The 200 amp. military generators are changed to 100 amp., and, in some cases, booster coil and junction box are replaced for 24v. systems.

All bolts are replaced by new units, and new bushings are installed in the propeller governor controls. Also installed new are cowl padding, hose, and clamps.

Mounts are dismantled, Magnafluxed to afford a careful inspection, and then reassembled. New Lord mountings are also installed. Inspection includes sand-blasting of exhaust stacks, followed by a careful check of the exhaust collector ring.

Major operation in the conversion involves simplification of the fuel system and related plumbing to conform to rigorous standard airline specifications.

Changes include replacement of cross feed plumbing, which formerly went around the vacuum pump en-route to the fuel pump. Direct connection not only increases the ease of inspection, but also saves 26 in. of line. PD12F-4 and F-5 carburetors replace the Army model.

Changeover—taking less than three days, barring parts shortages—increases the output of engine by approximately 50 hp.

Now being initiated at the SAC plant is a similar conversion of R-2000s for Douglas C-54 and DC-4 operation.

Ernie Hansen—overhaul and repair expert, who personally devised SAC's conversion procedure—is in charge of Southwest Airmotive's remodeling plan.

Portable Electrical Tester Insures Quick Airliner Checks

Handily used for in-the-craft testing, this compact time-saving unit affords reliable line inspection of electrical systems and instruments.

TROUBLE SHOOTING of electrical installations on Pan American World Airways' Clippers has been greatly simplified with the advent of a testing set designed by Salvatore T. Vicale, instructor in the line's Atlantic Div. maintenance school at La Guardia Field.

Previously, trouble shooting electrical systems and instruments generally resulted in removal of instruments from the craft for routing to the instrument shop for complete check. Not infrequently, it was found that the instrument was faultless and that trouble existed elsewhere. Also, trouble shooting the electrical installations required the use of various types of testing equipment of bulky proportions and especially inconvenient for line checks.

The new testing box now makes it possible to check instruments without removing them from the aircraft. The entire electrical system can be quickly and accurately checked with the unit, or individual checks can be made of the instruments.

The test unit is a compact inexpensive device, convenient to carry, simple to operate, and requires negligible maintenance. Fitted in a little wooden box, complete with handle, the tester contains a 30v. d.c. voltmeter, 5,000-ohm potentiometer, 500-ohm potentiometer, 14-pin Cannon plug, 14-pin Cannon receptacle, 2 4-pin Cannon receptacles, 2-pin Cannon receptacle, toggle switch, 12-point rotary switch, 4 knobs for potentiometers, Autosyn and switch, 4 leads, test prods and clips, and ¼ in. Bakelite panel.

Fitted in small box for easy carrying, this compact electrical tester, designed by PAA's Atlantic Div. maintenance school instructor, S. T. Vicale simplifies system and instrument checking aboard aircraft. Complementary ohmeter-ammeter unit is pocket-size.

Using electrical tester aboard Lockheed Constellation, Arthur Lumme short service crew leadman at Panam's Atlantic Div. maintenance base, performs thorough instrument check. Small ohmeter-ammeter unit is seen in breast pocket.

The device operates as a Flux Gate test transmitter and Autosyn test transmitter, provides a precision voltmeter for checking and setting ship's voltmeter, and also provides for indicator operation of thermocouple, bridge thermometer, and ratiometer.

Designed to afford an absolute minimum of connections and set operation, the unit easily enables obtaining of required information relevant to condition of the system being tested.

The electrical indicator with which the tester is equipped is of standard commercial design and rugged construction. Its accuracy is well within the desired limits, and previous experience with it insures reliability. And other items of the unit require almost no maintenance, discounting replacement of the standard flashlight battery.

Elimination of unnecessary instrument changes decreases the load on the instrument shop, lengthens period between instrument changes and provides an accurate operation check, lessening possibility of instrument failure in flight.

In connection with the testing unit, there is an 0-30 ohmeter and 0-30 ammeter unit which incorporates two test lights and buzzer. A handy little pocket-sized unit designed to Panam engineers' specifications, it is used in checking continuity of lines, also in synchronization of magnetos. The buzzer is used when the ship's power is out.

The testing device and ohmeter-ammeter combination unit have notable utility during overhaul periods, as well as for line maintenance at base and route stations, where trouble shooting can be expedited without accompanying delay.

Nose Gear Holding-Fixture Simplifies Installation Details

• This fixture, designed to hold and install C-54 350-lb. nose gear, features one-man operation as against three men formerly required, and eliminates possibility of damage to craft and injury to personnel. Saved, also, is approximately 45 min. of installation time.

Castors on the bottom of the fixture permit rolling the gear into installation position. The device, 52 in. high and 42 in. long, is equipped with legs so that nose wheel fork can be laid parallel with floor, and parts may be subassembled before installing the fork to craft. Fork can be raised upright on fixture when installation is made.

Fixture was designed by Clarence V. Hansen, Douglas mechanic seen in photo.

Vise Conveniently Holds Electrical Plugs for Soldering

• To eliminate electrical plug rejections resulting from damage when worked in ordinary vises, and to provide proper holding angle for soldering, this vise was developed by Robert K. Phillips, Douglas leadman, with attendant annual savings of 915 man-hours.

Device, equipped with steel base plate with bracket at side extremities, has rod (passing through one bracket) fitted with tension spring and V-jaw welded at rod end. Similar V-jaw is welded to bolt shank which runs through other bracket. By pressing spring back, plug may be placed between jaws and by releasing spring, plug is held securely without undue pressure. Angle at which plug may be worked is adjusted by tightening wing nut on bolt shank.

Powered Valve Grinder Improves Thermos Repair

• This reversible air-operated valve grinder is feature of new method for reseating thermos bottle spigot core, devised by F. L. Siemering, mechanic's helper at UAL's Cheyenne maintenance base. Use of device affords substantial time saving in bottle maintenance and provides a more satisfactory lapping and smoothing operation than is obtained with hand reseating.

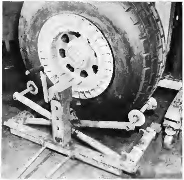
Both methods employ grinding compound, but the powered grinder is more effective for cutting evenly and leaves no burrs or creases.

Drill Jig Lends Speed To Cabin Cloth Installation

• Precisely spotting fuselage frame hole locations for rapid installation of main cabin lining, this drill jig is a handy aid for conversion or modification of military craft for transport use.

Made of iron and formed to the contour of the craft, it is clamped in position on the frame and with a single set-up numerous accurately spaced holes may be drilled to insure coordination with trim strip holes. This obviates the need for aligning and holding the various trim strips in position. As used at the Douglas plant, the device has saved approximately 128 man-hours per plane.

Jig was designed by Douglas assistant foreman Melvin N. Pederson.



Landing Wheel Fixture Facilitates Handling

• Developed to pick up a landing wheel so that it may be raised, lowered, or tipped to facilitate installation of brakes, this fixture permits rotation of wheel and does not interfere with work on the hub. For installation, the wheel can be lifted from the floor and attached to axle with a minimum of effort.

Time saving is considerable, and one man can install the wheel, whereas three were formerly required.

Fixture was devised by Orison L. Long, processor, and Clarence V. Hansen, mechanic, Douglas Aircraft Co.

Lacing Tool Eases Canvas Assembly

• Minimizing bodily strain and speeding work, holding tool seen here applies correct tension to canvas of bunk and frame while rope lacing is threaded through eyelets.

Yoke portion of tool has pin welded at closed end for positioning in eyelet of bunk canvas. Arm component of tool, attached via slot and clevis bolt to yoke so as to afford hinge action, has hook end for engaging eyelet in frame canvas, and is adjusted to various job requirements by handle screw action.

With tool secured in eyelets, canvas is pulled tight by contracting tool in jack-knife fashion.

Unit was developed by Leo P. LaVigne, Douglas upholsterer.

Comfort Can Be Compatible With Design Efficiency

By **WILLIAM LAWRENCE LEWIS**, *Aeronautical Engineer*

In this study the author has evolved a unique approach to personal aircraft design. He starts with the neglected factors of passenger comfort and utility—then aerodynamic and structural efficiencies follow in highly satisfactory sequence. Evolution of this proposed ideal approach will provide food for thought for designers who seek to create more useful airplanes.

If ever a sound personal plane manufacturing industry is to be developed, we must approach the technical problems involved in a way that will produce a more advanced and satisfactory plane—one that will be in step with the times. And as a preliminary requisite to any design procedure there is needed a set of specifications based upon the full requirements expected of the product—specifications similar to those which follow

Accommodations

Comfort for the occupants is of first importance. Aircraft designers will do well to follow the example set by designers of automobile bodies in providing easy entrance through wide doors and a short step up from the ground. Air properly conditioned for temperature and altitude pressure is an important contribution to comfort. Besides avoiding extreme outside temperatures, it is essential that inside air be fresh—uncontaminated by engine fumes, gasoline vapors, and other unpleasant odors.

Maximum visibility for the pilot and well arranged window space are absolutely essential to insure safety in the air, and in landing and taxiing. The same facilities, including adequate cabin lighting, are essential for the passengers' full enjoyment. Engine noise and vibration must be completely isolated from the passenger compartment to guarantee restful travel. This can be achieved most effectively if the power plant is placed to the rear of the body. Insulation will reduce any airflow noise and will also effectively control inside temperature.

Seats should be generously wide, well upholstered, with ample arm rests and comfortable high backs. The pilot's seat position need not be adjustable for control purposes, since the rudder pedals would be eliminated. The remaining brake pedal and starter will be used only for short intervals while the plane is on the ground.

Space throughout the interior must be ample in width and headroom, with adequate provision for baggage and easy access to the luggage compartment for handling large articles. Luggage compartmentation to the rear of the passenger space affords a baffle against power plant noise and vibration. Additional storage space should be provided under seats and in easily accessible inside compartments. A weight allowance of 60 lb is the least that should be made for baggage.

Number of Occupants

No private plane can be considered adequate for air travel unless it is comparable in utility to a sedan type car accommodating a family of four—two adults and two grown children. Two-place planes following the procedures outlined can be designed, but they will have considerable less use-value. Weight allowances and performance characteristics will be calculated on the four-place basis, or 2500 lb gross.

Complete equipment essential to safe, easy operation of small aircraft must be included as standard. Interpretation of what is essential should be very broad, at least including such items as instruments for safe flying in all kinds of weather, provision for radar when developed for general use, radio for avigation and entertainment, automatic temperature regulation, self starting power units, automatically regulated propelling devices (propeller or jet); hydraulically actuated fully-retractable landing gear, wing flaps, and door closers, all controlled automatically, "push button" automatic flight control, radio directed, and simplified manual flight controls, eliminating rudder pedals and substituting easily mastered steering wheel controls.

At this point it might be well to discuss briefly the matter of costs, although the cost of an airplane in the category under consideration cannot

Fig. 1. As a basic concept, a streamlined body and wing is irreducible minimum for designs too small to be fully constituted within a wing alone. A combination such as shown here has least possible drag.

possibly be predetermined on any logical basis because there is nothing with which it may be compared, except perhaps the automobile

Certainly the extensive use of the auto and its effect on modern living is a direct result of its value to the user for pleasure or profit The same cannot be said for existing personal planes It is utterly fallacious to base costs on seating capacity or on a weight basis, for instance Any such arbitrary standard completely ignores customer-acceptance, which is the factor of primary importance affecting probable costs. Costs can only be reduced to an economic level by first designing a vastly superior product which, by virtue of its outstanding use-value, will create a demand of such proportions as to justify mass production Obviously, it must be designed so it can be mass-produced — not just cheaply made[1]

Better aircraft can be made if designers will employ at least a modicum of ingenuity in devising ways to avoid consumer dissatisfaction prevalent with aircraft engineered according to the strictly traditional pattern Orthodox design forms are automatically ruled out by many of the listed requirements, also by the unavoidable necessity for obtaining greater economies in manufacture, upkeep, and operation

Unless a product is satisfactory in every way, certain outstanding features will seldom nullify its serious shortcomings Thus it is with airplane performance—for instance, superior speed characteristics will not long compensate for a crowded, uncomfortable cabin Foul air, poor visibility, abnormal maintenance costs, and high depreciation make performance a secondary consideration.

Good form and external simplicity have such a profound influence on performance that they may be properly regarded as being basic design factors Both contribute to attaining minimum drag and low production costs. An airplane design concept exemplifying those fundamentals to the maximum degree would consist only of a stream

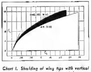


Chart I. Shielding of wing tips with vertical surfaces increases maximum lift and decreases total wing drag compared to a plain wing.

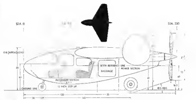


Fig. 2. In this design, wide range of visibility for pilot and minimum obstruction of view for passengers are provided, with all sections of plane readily accessible. Also, maximum economies of weight and space are achieved by compactness of arrangement.

lined body and a lifting surface—the maximum simplification of a pure flying wing being impractical for small aircraft By rigidly following the basic "monosurface" idea, designers will avoid many objectionable features inherent in conventional aircraft, and be able to incorporate the most desirable features in their designs (Fig. 1).

The monosurface design form removes any excuse for not obtaining the smoothest and most aerodynamically efficient space shape for enveloping the contents of the airplane A body having the contours of modern high speed airfoils will maintain maximum laminar airflow and have minimum parasite drag[4]

In designing the body, the most logical procedure is (1) to determine the amount of space required to hold the occupants, (2) provide sufficient baggage space, and (3) enclose the engine and propulsion unit (named in the order of their position relative to the front of the body)

Space for the occupants is determined from automobile seating dimensions such as those illustrated in Fig 2 Adequate baggage space is assumed to be 3 ft in length, with the engine and propulsion unit length (including gear reduction), determined from the space required to accommodate whatever engine is selected to power the craft Blocking-in the cabin, baggage, and power plant arrangement provides a basis for enveloping it within an aerodynamically suitable space shape The effect of this arrangement on C G location is shown in the balance diagram, Fig 3

The monosurface design form makes possible modern plastic-molding manufacturing techniques It is a fortunate coincidence that airplane bodies which are highly efficient aerodynamically can also be the cheapest to build The smoother the curves, the easier the parts are to form when advanced production techniques are followed The parts can be molded from thin sheets of materials, built up to any desired thickness, and cemented together by high pressure and heat, using recently developed thermoplastic adhesives

Body half-sections, wing covering shells, control surfaces, and similar large structural elements come from the molding dies with perfectly smooth glass-hard, scratch-proof surfaces (see Fig 4). If the molding materials used are impregnated with color, expensive finishing of the molded surfaces is completely abolished and lacquer or paint never need be subsequently applied to cover any marred or worn portions Materials held suitable for manufacturing large contoured sections are Various sheet plastics, paper, wood veneer, glass fabric, and many others

Another advantage for molding is the use of two shells for the body, one inside the other, separated by a sufficiently wide space to accommodate structural forming members between them, with thermal and sound insulation filling the remainder The inner shell does away with any compartment wall covering Like the outer shell, it may be made of color-impregnated material, the color in this case being suitable for interiors

Compactness, a feature especially characterizing the monosurface idea is readily apparent from the way the entire body space is made useful Resultant small amount of light metal structure necessary to take the flying and landing loads is due to the simplicity of the basic design. All loads are concentrated in one central girder, the enveloping body shell serving only to give the plane good form and to protect the interior from the airstream

[1] For an interesting commentary see Simplified Design for Low Cost Airplanes by Alfred Marchev Jan 41 Aeronautical Engineering Review

[4] Report 492—Tests of 16 Related Airfoils at High Speeds by John Stack and Albert E von Doenhoff National Advisory Committee for Aeronautics 1934

With the preliminary space shape determined, the remaining basic element, the wing, must be designed, and subsequently arranged, relative to the body One of several innovations comprising the monosurface concept is the medium low aspect ratio wing design with its reduced span and lengthened centerline airfoil chord (Fig 5) Wings of this type have many advantages which to a great extent nullify theoretical imperfections supposed to be inseparably associated with low aspect ratios

Ordinarily, when comparing wings of identical airfoil section and equal area, the one with the largest aspect ratio will have the smallest induced drag The profile drag, being independent of aspect ratio, remains the same in either case On the other hand, decreasing the span, at the same time keeping the tip chord small, lengthens the centerline chord and thus concentrates a greater portion of the area toward the middle of the span Likewise, the airfoil section in the middle increases in thickness because its length is increased, although the ratio of airfoil depth to chord length may remain the same as for a wing of higher aspect ratio Here is where some aerodynamic improvement may result by taking advantage of the greater section depth of the shorter span wing

To reduce wing profile drag to the minimum, it is desirable to make the wing section thin It cannot be made too thin, however, because there must be sufficient space allowed to accommodate retracted landing gear wheels and fuel tanks, while also providing for light, efficient wing structure. These

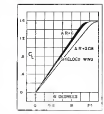


Chart II. Comparing slope of lift curve for low- and high-aspect ratio wings and a shielded-tip wing.

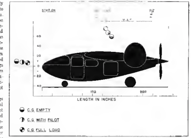


Fig 3 Balance diagram, showing small affect of varying loads on C.G. location.

are practical considerations limiting the extent to which the airfoil thickness may be reduced Consequently, the wing profile drag coefficient is likely to be less than it would be for an airfoil having a percentage thickness great enough to obtain an equal space within the shorter chord of a seemingly more efficient higher aspect ratio wing Regardless of airfoil thickness (but for an identical value of the lift coefficient) the induced drag for a wing will be the same, but the profile drag will be less for the thinner section The profile drag does now, however, decrease as rapidly in relation to the airfoil thickness as the induced drag is increased by reducing the aspect ratio

To make this point clear, suppose a 15% thickness wing has an aspect ratio of 6, its total drag coefficient for C_L = 0.20 is 0.0091, compared to 0.106 for a 9% wing aspect ratio 3.08 Despite its being proportionately thinner, the lower aspect ratio wing provides considerably more space than the higher percentage wing, because its chord is longer The negligibly small difference in the drag of the two wings holds for lift coefficients in the high- and cruising-speed range, where drag critically affects performance. In the higher lift ranges, the low aspect wing drag increases somewhat more rapidly than it does in the case of higher aspect ratio wings. However, the effect on overall performance in those ranges of lift is not too important.

The wing planform depends upon many design considerations which cannot be gone into here because of their detailed nature The wing will be affected greatly by the designer's regard for simplified internal structure with the span selected for a particular aspect ratio, the latter also depending upon the predetermined relation of the wing area to the gross weight

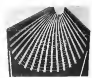


Fig 4 Structure of fuselage pressure-molding die before sheet steel plating has been spot-welded to it Contours for forming members are picked up from loft lines of full-size plane, and longitudinal stringers are located same way Body half-sections are molded in these dies in one piece, with integral door and window frames flush with outer surface. Bulkhead forming members and structural attachments are also integrally molded in one operation (Design, construction, and manner of use of this type of pressure-molding die, are covered by U. S Patent 2,356,860 issued to author.)

Referring to design simplicity of the medium low aspect ratio planform, there are many arrangements to which wings of this type conform in a manner gratifying to designers who seldom have had at their disposal sufficient space in which to accommodate structures and various mechanisms of efficient, straightforward design. Crowd

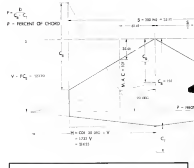


Fig 5 Wing planform is designed to permit straightforward construction by eliminating unnecessary angles which complicate fittings and interior structure. Because mean aerodynamic chord is longer in this planform, permissible C.G. travel is greater for a given chord percentage variation than for a wing of higher aspect ratio.

PERFORMANCE CHARACTERISTICS

PERFORMANCE BASED ON 200 HP NORMAL MAXIMUM; 150 HP AT CRUISING RPM; AND FULLY RETRACTED ALIGHTING GEAR

VELOCITIES AT VARIOUS ALTITUDES	VELOCITIES IN MPH		
ALTITUDE	MAXIMUM	CRUISING	MINIMUM
SEA LEVEL	216	195	51
3000 FEET	214	193	55
10000 FEET	212	183	59
20000 FEET	186	152	
23000 FEET	180	(SERVICE CEILING)	

RATE OF CLIMB	
SEA LEVEL	2180 FPM
5000 FEET	1430 FPM
10000 FEET	1250 FPM
20000 FEET	405 FPM
ABSOLUTE CEILING	23000 FT
SERVICE CEILING	23000 FT
OPTIMUM WEIGHT FOR MAX VELOCITY	3000 LBS
MAXIMUM VELOCITY FOR OPTIMUM WEIGHT	216 MPH
MINIMUM VELOCITY FOR OPTIMUM WEIGHT	56 MPH
MINIMUM VELOCITY FOR W = 2500 POUNDS	51 MPH
FOR MAX $\frac{L}{D}$ MAXIMUM WEIGHT IS 6500 POUNDS VELOCITY	166 MPH
FOR LEVEL FLIGHT AND BEST CLIMB MIN VELOCITY	83 MPH
MINIMUM POWER FOR LEVEL FLIGHT AT SEA LEVEL	36 HP
MAXIMUM $\frac{L}{D}$ RATIO	10
SPEED RANGE RATIO MAXIMUM VELOCITY	4.23
SPEED RANGE RATIO CRUISING VELOCITY	3.82

ALIGHTING GEAR EXTENDED

MAXIMUM VELOCITY AT SEA LEVEL	172 MPH
MAXIMUM $\frac{L}{D}$ RATIO	13

Chart III. Performance characteristics.

ing things into too small a space inevitably results in expensive complications which increase the cost of production.

Considerable weight may be eliminated as the result of using deep wing sections. Consequently, wing beams and similar structures may be made up of simple standard sections, possibly stainless steel members spotwelded together, attached to plates molded into the plastic wing shells. Here again, as in the case of the body shell, the wing covering may be molded of low density synthetic product or natural material. Much of the internal structure necessitated by orthodox design (such as ribs) can be eliminated by molding stiffeners which are integral with the covering shell.

By purposely avoiding trick angles to the chord plane, such as eliminating incidence and dihedral, low production costs rather than the opposite are designed into the craft. A perfectly horizontal chord plane dispenses with complicated attachment fittings having compound angles and other expensive geometrical complications. A practical illustration is in the case of the rear spar, which is at right angles to the centerline, locating it and the front spar, as well, on a percentage chord line of the wing. Left- and right-hand parts can be largely eliminated, making production cheaper.

A necessary deviation from the basically simplified monosurface design, dictated by aerodynamic considerations, is the adding of vertical surfaces to the wing tips. There are many advantages to be gained by their addition. They produce a degree of directional stability ordinarily accomplished by the conventional tail, but, what is more important, lower the total wing drag by decreasing the induced drag and, consequently, improve the lift curve slope at no extra cost to the overall arrangement (Chart I). The medium low aspect ratio wing with end surfaces adds to the many desirable features of the wing type used here, by preventing wing tip losses and inhibiting tip stalling. It is seldom that the designer is able to realize so many positive benefits and sacrifice so little.

Location of the wing on the body is the next step. The high wing position is the most logical, especially for an airplane of this type. The only major advantage to a low wing arrangement is, possibly, a shorter landing gear, but in many cases it is a doubtful advantage. Disadvantages which rule it out are: Relatively poor stability, interference with the field of vision, considerable possibility of damage resulting from accidental contact with the ground, damage to upper surface by "wing walkers", interference with passenger entrance and baggage space, and serious deficiencies in the airflow, especially at large values of the lift coefficient. The mid wing position eliminates some objections to the low position, but the advantages of the high position are not duplicated by the mid-position.

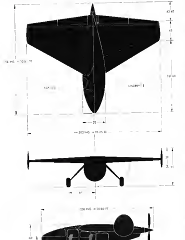


Chart IV. Factors of weights.

WEIGHT TABULATION

Group Weights:	
Wing group	366 lb
Body group	414 lb
Alighting gear group	178 lb
Power plant group	549 lb
Fixed equipment group	258 lb
Total Empty Weight	1 765 lb
Useful Load:	
Pilot	170 lb
Passengers 2 adults or 1 adult and 2 children (total = 3 max.)	340 lb
Baggage	60 lb
Fuel (2.5 hr. at cruising)	225 lb
Oil (2 gal.)	15 lb
Total Useful Load	810 lb
Total Loaded Weight	2 575 lb

Fig. 6 Three-view dimensioned diagram.

Several previously cited qualifications of the ideal airplane are met by the upper wing location. Visibility is attained to the fullest extent, and the body, being close to the ground, is easily entered by one step up. Further, baggage loading is unhampered; the power section and propeller are effectively isolated from the rest of the airplane; the airplane can be easily serviced and quickly inspected, the best body shape and wing combination is obtained, and, in the event of a crash, the sturdy structure by which the engine is secured, together with the intervening baggage compartment, offer protection to the occupants. Because most of the wing area is in the middle, the airfoil section is deepest there. Consequently a large part of the normal wing structure becomes also the body structure, thus economizing on weight and utilizing space most efficiently. Furthermore, the loads on the airplane are concentrated in this area, where the structure is most advantageously arranged to distribute them.

Placement of the wing surface tangent to the upper body curve to the extent it is in this design (60% of the body length) results in an exceptionally smooth airflow over both the wing and the body. As a result of this fortunate combination, laminar flow is achieved to a degree which cannot conceivably be duplicated in poorly designed body shapes and indifferent wing combinations. Continuously smooth airflow at various angles of attack is indicated by wind tunnel lift curves showing not only a larger lift coefficient for the high wing combina-

(Turn to page 145)

Standardized Airframe Assembly Fixtures

By LEE WORLEY, *Fairchild Aircraft Div., Fairchild Engine & Airplane Corp*

An Allied technical observer reveals how Germans used stock clamps, tubing and support fittings for all types of planes—from fighters to 200,000-lb. flying boats.

When the Allies invaded Germany they were accompanied by industrial investigators who were searching for Nazi war secrets. Among these investigators, and those who followed after VE Day, were specialists from various industries including aviation, plastics, textiles, chemicals, etc.

As one of the aircraft representatives, I had the opportunity of visiting many of the German aircraft plants and of observing their engineering and manufacturing methods. The first plants visited were Focke-Wulf and Weserflug in the Bremen area. In the many plants operated by these two companies the same type of airframe assembly fixtures were noted. These fixtures were simple in design, consisting of bolted construction using cast steel clamps, cast support bases and steel tubes. They seemed to be adequate for the usual jig requirements for rigidity in all planes, open space, low cost and quick assembly to accommodate any structural component.

Continuing our investigation, we moved to Hamburg and from there visited the main aircraft plant of Blohm and Voss at Finkenwerder. Here again were found the same type of assembly fixtures using the cast clamp and support fittings. At this point, it was felt that these fixtures were worth further investigation to determine if the cast items had been standardized and if they were in use by the entire German aircraft industry. This proved to be true not only in Germany, but in the occupied countries where German aircraft production was augmented.

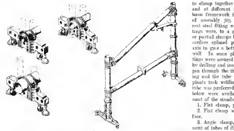
The cast fittings, completely machined to standard drawings, were available from stock from several sources. These standardized assembly fixtures were so designed that the fittings required for a wing jig would also be suitable for the basic jig structure for a fuselage, empennage, or flying boat hull. Also, with the wide variety of standard cast fittings available it was possible to assemble any arrangement of tubes in any type of jig, either single or double frame.

Given below is a description of the assembly jig details taken from the notes and information collected during visits to various aircraft plants. The information, definitely, does not cover the complete set-up, especially, as to the sizes of tubes and number of different types of fittings used. It will, however, serve to give a good general idea of how the standardization was accomplished.

Standard Tube Sizes: On the German standard sheets obtained, only five sizes of tubes are listed as standard for assembly fixtures. These are 83, 114, 165, 216, and 318 mm diameter with wall thickness ranging from 3.5 to 8.0 mm. Only commercial grade steel tubes are used (Tube length not standardized). The five sizes listed appear to be adequate for almost any size fixture. This is borne out by the fact that a hull for a flying boat of approximately 200,000 lb gross weight was assembled in a jig using tubes within the five sizes. Messerschmitt, on the other hand, was reported to use eight sizes of tubes ranging from 24 to 30 mm. diameter and in France six sizes were considered standard.

Standard Cast Fittings: In order to clamp together different size tubes and at different angles to form the basic framework for any type or size of assembly jig, many standardized cast steel fitting were used. These fittings were, to a great extent, clamps or partial clamps having the clamping surface splined parallel to the tube axis to give a better grip on the tube wall. In some plants the clamp fittings were secured in the final location by drilling and inserting a taper dowel pin through the thin part of the casting and the tube wall, while in other plants tack welding the clamp to the tube was preferred. The fittings listed below were available in sizes to fit most of the standard tube sizes.

1. Flat clamp, plain.
2. Flat clamp with attachment surface.
3. Angle clamp, plain, for attachment of tubes of diameter in one plane and at right angles.
4. Angle clamp, for attachment of tubes of different diameters, in one plane and at right angles
5. Angle clamp, for attachment of tubes of different diameters, in one plane and at right angles, incorporating lug for diagonal brace.
6. Cross clamp, for clamping tubes in two places at right angle.
7. Flanged clamp, for attachment of work supports, etc
8. Foot clamp, may be used as item 7 above or for attachment of frame to base support
9. Link clamp, half clamp with provision for attachment, at any angle, of work support or bracing member.
10. Swivel block, used as spacer between two vertical support tubes and having provisions for different angular positions for horizontal members.
11. Frame support, fittings available in several types for large or small jig frames.
12. Strut bearing, for attachment of diagonal tube brace to frame support.



Three types of standardized jig support fittings used by Germans are shown at left with use of stock clamps and tubing shown at right

Standard Machined Fittings: In addition to the standardized tubes and cast fittings it was also necessary to provide other parts for assembly of the jig frame. Some of these fittings are:

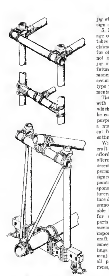
1. Strut end, plain, for 83 mm diameter brace tubes
2. Strut end, adjustable, for 83 mm diameter brace tubes
3. Ball foot, adjustable self aligning jig support.
4. Tie down clamp, for attachment of ball foot to jig foundation.
5. Castered roller, for convenience in moving jig

Special Fittings: There are certain fittings which must be designed for each application. These consist of work supports, attachment points and hinge locators. Standardization of such parts is almost impossible for the entire industry, although it was noted that several individual companies had made some progress along this line to meet their own requirements.

The accompanying illustrations, reproduced from German standard sheets, show a number of the cast fitting details and perspective views of design examples of several jig frame assemblies, including the standard adjustable support fittings.

There are many advantages of the knock-down type of fixture over the permanent welded type, especially when the quantity of components to be made is low. Some of these advantages are:

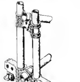
1. Reduced time required for design and drafting of assembly fixture. For the basic structure the tool designer merely selects, from a standards book, the fittings required, makes an outline drawing calling out the standard fittings. The work supports, hinge locators and attachment points are the only parts requiring special design for each application.
2. Ideally suited for experimental work and low quantity production, but not limited by the number of components to be assembled.
3. Standard cast fittings completely machined and adjustable supports available from stock from outside sources.
4. Easy adjustment of any part of jig when necessary to accommodate design changes.
5. Economical due to high percentage of salvage. Almost 100% of the tubes and standard fittings may be reclaimed for re-use in assembly fixtures for other components. Salvaged parts not immediately required on another jig are stored in the tool room for future requirement. The airframe manufacturer will, in a short time, accumulate a sufficient quantity of all type parts to accommodate his experimental requirements.



Detail drawings from original German catalogs show assembly of airframe jig ends made from standardized parts. Fixtures made from such parts were used not only throughout Germany but in plants operated in occupied countries

The above is very much in contrast with our present welded structure which requires that heavy wall tubing be cut and fitted in clusters for a one-purpose jig with salvage consisting of a number of short tubes, which are cut from the assembled fixture with a cutting torch.

With the vast curtailment in aircraft production, industry cannot afford to overlook the advantages offered by the knock-down type of assembly fixtures over the present permanent welded type, specially designed and constructed for each component. A coordinated program, sponsored by the aircraft manufacturers, for standardizing assembly fixture details could, without doubt, prove economically worth while if the available information is carefully studied for simplification and reduction of parts required. Standardization of assembly fixtures has the same relative importance as standardization of aircraft parts. Commitments by aircraft concerns adopting standardized jig fittings could encourage the establishment of outside supply sources where all parts might be carried as stock items, available for immediate delivery.



Standardized cast attachment fittings permitted Germans to set up wide variety of assembly fixtures having high salvage value. Such fixtures could be used for either small or large production schedules

Launching Aircraft Electrically

By M. F. JONES, *Design Engineer, Transportation & Generator Div., Westinghouse Electric Corp*

New assisted takeoff system shows ability to get larger payloads out of present or future airports.

GIANT AIRLINERS MAY now be launched by electric catapults —electropults—after a take off run of only 500 ft. with no discomfort to passengers. Two powerful electropults, employing a unique form of linear electric motor having a very low inertia characteristic, have been designed and built for the U. S. Navy. Both models have been installed on Naval Airports and tested extensively to verify the capacity and other operating features. These tests included a large number of "deadload" accelerations, or calibration runs, followed by a series of actual flyaway launchings of military aircraft.

First of these two designs, Type XEE, is on Mustin Field, Philadelphia Navy Yard. The second, Type XE-2, is at the Naval Air Test Center, Patuxent River, Md. It was built as a flight test facility for launching very high speed aircraft including jet propelled and robot types. It has much greater capacity than the XEE both for take-off speed and size of aircraft which can be launched. The largest plane launched to date is the Navy PBJ (Army's B-25). The calibration test charts indicate that it can launch the largest airplanes which the Navy operates, except giant flying boats of the Mars class. This includes the heavy bombers such as the PB 4Y2 (Army's B-24) as well as the largest transport planes. It can launch medium weight planes at speeds well above takeoff requirements of any known aircraft with the possible exception of some experimental robots or guided missiles. The indicated maximum effective launching speed is about 220 mph.

While these electropults employ the same basic operating principle—the linear induction motor—the two designs differ in many respects. In the description which follows the equipment referred to is the XE-2 except where other designs are mentioned.

The complete electropult equipment consists of two principal parts:

1. The linear induction motor which converts electrical energy into mechanical work in a form suitable for producing a rapid acceleration of an aircraft during its takeoff run.

2. The power generating station for supplying the electrical energy needed to operate the linear motor.

The linear motor is similar electrically to the ordinary rotating induction motor except that it is flat instead of circular. As in the ordinary induction motor the linear motor has (1) a "primary" winding to which the electric power is applied, and (2) a "secondary" winding in which currents are induced.

Lockheed P-80 poised for accelerated takeoff at end of Westinghouse electropult as officer gives signal for launching. At end of only 340-ft. run plane is airborne at 118 mph. This electropult is capable of launching four-engine bombers, proving design capable of handling much larger craft

In any induction motor the primary windings may be either on the moving or the stationary member. In the electropult the primary windings are on the moving member, which is the shuttle car and the secondary windings are on the stationary member, which is the track core, or active track. The use of moving primary windings involves current collecting shoes on the shuttle car. Nevertheless, the moving primary is found simpler and more practical than any scheme where the primary windings are on the stationary member.

The linear induction motor was chosen because, for assisted takeoff, it has two very important features without which the electropult appears utterly impractical. These are:

1. A very high power output in relation to the weight of moving parts.

2. No mechanical drive is required as the propelling force is developed directly at the air gap between the primary and secondary cores.

The XE-2 shuttle car weighs 4600 lb., and as adjusted and calibrated it develops a tractive force of 17,000 lb. or 3.7 times its own weight. This force is substantially constant for all speeds from zero to 220 mph, at which speed the car develops 10,000 hp. or 2.17 hp. per lb. of shuttle car. These results are quite spectacular when compared with other electrically powered vehicles. For hydraulic catapult purposes a ratio of force to weight of 3.7 is by no means spectacular, but with the moderate accelerating rates for which the electropult was built, this is a practical and effective design. A better ratio of force to weight, possibly up to 5.4 or 6, appears feasible.

The active track member is laid in a concrete trench so the core surface is level with that of the runway. It is composed of 76 sections, each a little more than 18 ft. long, for a total length of 1,382 ft. From the starting point, or zero mark, 1,000 ft. of this track is designed for acceleration and the remainder for braking, which is done electrically by reversing the power connections.

Secondary windings are squirrel cage type, but their resistance is progressively decreased in four steps along the accelerating track by use of materials of different resistivity for the slot bars and end connections of the cage winding. This stepped resistance is a very important factor in maintaining the tractive force constant as the speed increases. Analysis of calibration and other test data, as well as the absence of any surges, or even perceptible changes in acceleration when riding in a plane during takeoff, gives convincing evidence that the tractive force is maintained substantially constant at all speeds.

For the braking portion of the track from 1,000 to 1,310 ft. the cage is given a high resistance—approximately 15% higher than the starting step.

The active track consists of the following main parts:

1. The secondary core with its windings.

2. Running rails, including upper rails to restrain shuttle car from lifting during acceleration or braking period.

3. Copper collector rail system for three phase power.

4. Twin three phase low reactance bus bar feeder system with a series of taps to the collector rails.

5. A supporting frame structure including means to hold the abutting sections in alignment, plus adjustable supporting jack screws for accurate leveling.

The shuttle car is about $3\frac{1}{2}$ ft. wide, 12 ft. long and only $5\frac{1}{2}$ in. high above the track core. The accompanying cross-section drawing shows construction of the shuttle car and active track.

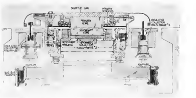
The ac power required amounts to about 12,000 kw. during a launching run, though maximum duration of this load is only about 15 sec. A small amount of ac power is needed to return the car to the starting point, after which no ac power is used until the next launching.

Under these conditions it is found possible, using a Pratt & Whitney Double Wasp Engine as prime mover, to store enough kinetic energy in a flywheel of reasonable size to carry this short time peak load. As direct coupling of the aircraft engine to the heavy flywheel set appears impractical, an electric drive, consisting of a 750 kw., 250 v., dc generator and a corresponding dc motor, is introduced between the prime mover and flywheel. The power station equipment consists of two major power units, some minor or auxiliary machines, and control apparatus. Major units are:

1. Prime mover unit consisting of aircraft engine and main dc generator which is driven through 2:1 reduction gears in engine nose.

2. Flywheel motor-generator unit consisting of flywheel, ac generator and dc motor used to accelerate flywheel.

Auxiliary machines include a gasoline engine-driven auxiliary power plant furnishing 125 v. direct current for control and driving an exciter set, an air compressor, and other auxiliaries.



Cross sectional drawing of 1,382-ft. long linear induction motor and shuttle car showing constuction and arrangement of electrical elements

Control apparatus includes a number of items the more important of which are:

1. Control stand for aircraft engine.

2. Main electrical control stand.

3. Two groups of quick acting electro-pneumatically operated locomotive-type main switches (electric contactors). One group is used for connecting ac generator to linear motor, either for forward or reverse power. The other group is for the 250 v. dc power switching which includes excitation for the ac generator and dc power to the shuttle car for final braking.

4. Regulator panel.

5. Instrument panel.

6. Two auxiliary control stands, or deck stands, for hand control of shuttle car and relaying signals to the power station.

This power station equipment is housed in an underground concrete building beside the electropult runway 650 ft. from the starting end. A concrete tunnel connects the power station to a pit below the center of the active track where power feeder lines are connected to the bus bar feeder system on the track. The power station has three main compartments, one for the prime mover unit, one for the flywheel motor-generator unit, and the third for the control or operating room.

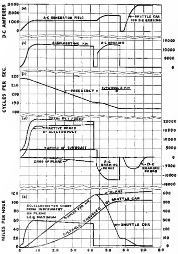
For land planes and amphibians the plane to be launched rides on its own wheels. The shuttle car tows it by a steel cable called the bridle. For planes having no wheels, such as seaplanes and robots, a launching cradle is used so that the plane and cradle are carried on the shuttle car.

The method of obtaining the specified speed with various sizes of aircraft is to change the length of takeoff run. The normal control settings cover a range of takeoff run lengths from 130 to 1,000 ft. in steps of about 36 ft. Full tractive force is used for all launchings.

In all electropult launchings the plane is held back until the force is applied so that propeller or jet thrust cannot start the run prematurely. The bridle also requires an initial tension to avoid a jerk at start and to insure that it remains in position on the tow fittings of the shuttle car and plane. On the XE-2 tensioning is obtained by a special unit built into the track just behind the shuttle car at the starting position. The hold back function is performed by the Navy's standard "hold back and release unit" which includes a calibrated steel ring that breaks when subjected to a force somewhat in excess of the maximum possible propeller thrust.

With the plane harnessed and the flywheel in the power station running at full speed, the electropult officer signals the pilot to bring his engines up to full power. When the pilot has complied, he gives the ready signal and the electropult officer then gives the launch signal which is executed by the operator at the control stand in the power station. The whole launching cycle from this point on is entirely automatic, including braking the shuttle car to a dead stop. After a typical launching the flywheel set is automatically accelerated to full speed, which requires about 2 min.

The electropult force is not applied with full strength instantly. On the XE-2 it requires nearly a full second for this force to build up to the maximum value. After about $\frac{1}{2}$ sec. there is force sufficient to break the



Graphical presentation of electropult action during launching: (a) shows field current buildup; (b) shows power used, (c) represents energy drawn from flywheel, (d) shows tractive forces, and (e) shows work resulting from forces in (d).

steel ring in the hold back unit and at this instant the takeoff run starts. No sharp jerk or surge is experienced, and therefore, accelerations up to 1 G when thus applied, involve no discomfort to seated passengers.

When shuttle car and plane have traveled the distance required for the specified takeoff speed, as determined from the calibration chart, the accelerating power is cut off automatically. This automatic cutoff is obtained by using local currents which flow through the tap connections from the feeder bus bars to collector rails for control purposes. The tap current rises sharply as the car passes each of these taps. The current in the selected tap actuates a relay in the power station, and thus interrupts the power.

Reverse power is applied automatically immediately after accelerating power is cut off, giving a very powerful braking action which decelerates the shuttle car at rates as high as 6 G. The ac braking power is cut off by means of an adjustable time element relay which has been set according to chart. Setting of this relay is not so precise as to cut the power off at the exact instant when the car reaches zero speed. This setting is purposely made too great in the case of the longer runs and too small in the shorter runs so that the car will always coast toward the mid-point of the track. Dynamic or dc braking is then applied to bring the car to a dead stop automatically.

Launching a P-80 would involve the following. Prior to the launching the officer in charge of catapult operations obtains this information—

1 Plane takeoff weight—9,800 lb.

2. Estimated net thrust of jet—1,500 lb. This is the amount left to help accelerate the plane after deducting allowance for rolling resistance and air drag with 30 deg. flaps.

3. Desired air speed at takeoff—115 mph.

4. Surface wind velocity—practically zero.

The officer is also informed that the plane is equipped with a recording accelerometer and that moving pictures and "still" photographs are to be made. He consults the calibration charts based on the deadload tests of the catapult and finds this plane requires the following control settings.

1 Distance selector drum, Position 29. The chart shows this should give a speed of 118 mph. and as there is no appreciable surface wind velocity, the drum is set on this position. This will give a takeoff run of about 350 ft.

2 Accelerating time element relay, 4.9 sec. This is a safety feature included in the control to interrupt the accelerating power if for any reason the distance control has not functioned on schedule.

3 AC braking time delay relay, 1.25 sec. This is less than the time required to stop the shuttle car so when the ac power is cut off the car is expected to coast forward until the dynamic or dc braking is applied.

4 Chronograph bar position 367 ft. This bar carries timing contacts for the Aberdeen chronograph used to measure launching speed. It is placed beside the track so that a projecting bar on the car strikes and momentarily closes three equally spaced contact devices.

Power station machines are started up about 15 min before the expected time of launching. This allows 5 min to warm up the aircraft engine, 8 min to accelerate the flywheel set from rest to full speed, leaving 3 min. margin for standby. During this time the plane is harnessed to the shuttle car with bridle and hold back line. The nose wheel of the plane rests on the track core just ahead of the shuttle car. The towing bridle passes in front of the towing lug or hook on the nose casting of the shuttle car and extends upward on each side to towing lugs on the under side of the wings at the front spars.

The line of towing force passes just above the center of gravity of the plane and thus tends to hold the nose wheel down against the track.

When the turbojet is running at full power the officer in charge gives the signal to launch. The start of the run occurs a second or so later when the signal has been transmitted to and executed by the operator in the power station, and the electropult force has built up to a value sufficient to break the steel ring in the hold back unit.

The accompanying graph shows the action of the electropult during this launching. Zero time on the graphs is the instant when the 250 v. dc power is applied to the field magnet windings of the ac generator. The main power circuits from the ac generator to the shuttle car are closed a moment earlier but no ac power is developed until the field circuit is closed.

As shown by the graphs, the buildup of the field current during the first second is shown by graph (a), and kilowatt load on the ac generator is shown by graph (b). This load on the ac generator causes the flywheel set to slow down so that the frequency of the ac power decreases as shown by graph (c). The tractive force developed by the shuttle car is shown by graph (d). Thrust of the turbojet, drag of the plane and the total net tractive force producing acceleration are also shown, in the group of graphs under (d). The work resulting from these forces is shown in graph (e). Acceleration is shown as measured by the accelerometer mounted on the plane.

The speed and distance graphs are calculated from the acceleration chart but the higher speed portions of these curves are verified by speed measurements with the Aberdeen chronograph. Note the pause in the accelerating rate at about 0.1 sec. This is explained as a momentary checking by the hold back line, of the plane's initial motion in taking up the slack in the system. At about 0.2 sec. the link broke and the takeoff run started. It also should be noted that no appreciable increase in the length of takeoff run can be charged to the gradual build up of the accelerating rate as the total travel during this build up is only about 10 ft.

Up to the present time the electropult has been applied, or seriously considered, only as a special assisted takeoff device. It has not come into direct competition with the hydraulic types catapult for shipboard use. In the range of capacity and speed for which it has been developed, the hydraulic design provides an excellent solution. As the speed and capacity requirements increase, however, it appears to lose effectiveness and encounter difficulties.

Shuttle car and section of linear motor track of electropult. Central portion of track is 12-in. wide core of Westinghouse linear induction motor. Uniformly spaced projecting elements are secondary squirrel cage windings. Primary core and windings are on under side of 5½-in. high shuttle car. Next to and outside of cage windings are channel shaped rails to prevent car from raising during braking.

The electropult, however, has no apparent limitations in speed or capacity within the range of requirements now foreseen. The only limitation seen is in maximum rate of acceleration, which due to the weight of the shuttle car, has a practical limit of about 3 G., near the normal limit of stress on pilot and plane. The electropult gains in effectiveness as the size increases. With the ever-increasing speed and weight of aircraft it seems reasonable to expect that electric catapults eventually may become the natural choice for the larger sizes of aircraft carriers.

Before discussing commercial applications of the electric catapult the closely related problem of landing should be considered, for unless a plane can land at an airport there is no advantage in being able to take off from it. If the objective is launching passenger planes at an acceleration of 1 G, some means of braking at a similar rate when landing should be found. From the published data on the most advanced designs of large airliners regarding landing distance and stall speeds (assuming landing speed = 1.2 × stall speed) the average or effective decelerating rate seems to be less than ½ G even when reverse propeller thrust is used. Unless this can be very materially improved the application of electropults depends on the use of some form of arresting gear.

This situation has led to some study of the electric catapult equipment as a decelerating device to reduce the landing run to about the same length as the takeoff run. The scheme consists in (1) accelerating the shuttle car up to almost the speed of the landing plane by means of electronic timing controls, (2) engaging, by resilient means on the shuttle car, an arresting hook on the plane, and (3) applying dynamic braking to the shuttle car, thus stopping the plane before reaching the end of the catapult track.

Whether it be this scheme or some other type of arresting equipment which is found more practical, it is believed that, in parallel with further development of the electropult, means can be developed to land the aircraft in distances to match takeoff runs. This appears reasonable as it is fundamentally easier to dissipate energy than to generate it, and therefore the landing problem should be simpler than launching.

On this basis, what then are the commercial uses for the electropult? The answer must come from the aviation industry. From experience in designing, building, and testing the two models for the Navy it is evident that performance data can be predetermined by calculations to an accuracy of about 5%. Design figures for an electropult to launch the largest existing airliners at 120 mph. with a takeoff run of 500 ft. have thus been made. Maximum acceleration would be about 1 G which would be built up gradually to this value during the first 2 sec. of the takeoff run. Seated passengers would not find this objectionable.

A few suggestions for applying such designs to advantage include.

1. Floating airports, or seadromes, for refueling in mid-ocean. Equipped with electropults these may take a form similar to aircraft carriers.

2 Barge type airports at water fronts of cities having suitable water areas near the business district.

3 Mid city airports. Slum elimination projects may be combined with airport development. The "flight deck" could be elevated several stories and the space below used for all purposes except takeoff and landing operations.

4 Reviving outgrown airports. The trend to larger and faster aircraft, requiring longer and longer runways, may lead to many situations where it is impractical to extend runways. In such cases installation of electropults may be the most economical solution.

Commercial application of the electropult depends on economic justification rather than design problems. An important factor in the situation is the ultimate standard in weight and takeoff speed for large airliners. An intelligent prediction on this matter will be required to avoid either outgrowing an electropult design before it has paid for itself, or, if such prediction is too high, carrying an investment for excess capacity that is never needed.

Spotwelding Technique For Primary Structures

PART I

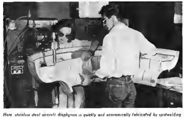
By FREDERICK S. DEVER, *Spotwelding Supervisor, Ryan Aeronautical Co.*

Stressing the growing value of spotwelding for the aircraft industry, Supervisor Dever analyzes pertinent structural design considerations and details basic preparatory steps for this fast and flexible fabrication process . . . First part of a two-part series.

PROCESS OF SPOTWELDING in primary fabrications is relatively new in the aircraft industry. Spotwelding had been used, in the past, for joining non-structural parts and for temporarily holding of parts prior to riveting or fusion welding. However, during the past decade, its employment has broadened, with achievement of a process that has successful application in many primary structures. This has come about because of increased knowledge of equipment and its use, thus improving shear strength and consistency of spotwelds.

Process specifications which basically govern the manufacturing procedures used are those issued by the Army and Navy Procurement Sections. As first written, these specifications confined spotwelding to a considerable extent, limiting the production applications. This was because equipment then available was not completely reliable, in that electrical circuits, moving parts, and relays demanded constant and careful maintenance. Also, spotwelding failures were encountered. Hence, it appeared desirable to prove process before relaxing requirements.

With increased use of the method and accumulation of service data, it was readily foreseen, at Ryan Aeronautical Co., that the technique could be utilized to excellent advantage. It is fast, economical, flexible, adds no weight to the structure, and is particularly desirable in joining sections exposed to the airstream. There is no resultant projection, and the surface exposed can be held to a maximum variation of only .004 in.



Here stainless steel aircraft diaphragm is quickly and economically fabricated by spotwelding

Indentation may be almost eliminated on one side of the sheet by having a combination of contoured electrodes. Variety of electrodes which can be used make the process so flexible that even polished sheet can be spotwelded without seriously affecting the fine finish. And another advantage is that three or more sheets can be spotwelded together—made possible because the process depends upon development of maximum resistance at inner facings of the sheets.

Since strength of the spotweld must necessarily be a shear function, it follows that the design of the parts to be welded can make or break the resultant assembly so far as satisfactory service operation is concerned. While it is difficult to list any given set of conditions as a criterion for good design, the following suggestions, developed at our company, should produce desirable results:

1. Loads to be applied should be shear loads, because spotwelds inherently will develop focal points of stress concentration at the edges of the weld and inner faces of the sheets, if tension or angle loads are applied.

2. Tension loadings should never be used because strengths developed in tension are erratic and accordingly are not reliable.

3. Compression loadings are satisfactory, provided the design will not allow the spotweld to be placed in tension as a result of shifting or movement of the compression loading. An assembly made from light gage material demands special care to insure that the stress does not occur in a plane which will cause buckling, since the spotweld loading may change from shear to tension.

4. Ample edge distances must be maintained—necessary for two reasons: (a) To have a sufficient area, over which the pressure can be applied, surrounding the spotweld, and (b) to have an adequate amount of *wrought* material so that the stresses can be carried over and around the cast spotweld metal.

Required edge distance will vary, depending upon type and thickness of material. It must be remembered that as material thickness increases, diameter of the spotweld must be increased to meet minimum required shear loadings. Spotweld diameters for different metal thicknesses and minimum edge distances are given in Figs. 1 and 2.

Patterns (spot groupings) are of great importance in the design of spotweld structures. They are similar to rivet patterns and spacing used to obtain high joint efficiency, and can be divided into three rough classifications:

1. *Single row.* Here, a single row of spotwelds is used, with a definite center-to-center dimension. This joint pattern will require a minimum of overlapping of sheets. The overlap will be determined by material thicknesses used, which, in turn, through minimum shear strengths required, will determine other dimensions such as spotweld diameter and edge distance. Center-to-center spacings and joint efficiency graphs giving recommended dimensions are shown in Fig. 3.

2. *Double row.* This design requires a greater overlap of material, but joint efficiency will be from 95 to 100% if the spotweld spacings given in Fig. 4 are used. It is often good practice to utilize the double row pattern even though spotweld strengths may be below average minimum. This is because the pattern will evenly distribute the loading, resulting in an assembly giving longer and more satisfactory service life than will a single row of spotwelds of higher average shear values. Under severe vibration and fatigue stress, the double row joint has been found to be more suitable.

3. *Double row staggered.* In this pattern, joint efficiency is approximately equal to the double row pattern, but is not as well stressed. There is considerable difference of opinion as to which joint is more efficient for general service usage. Material overlap in the double row staggered pattern is less than that of the double row joint.

Materials which can be spotwelded are almost unlimited, although those developing extreme hardness as a result of heat treatment may present difficulties rendering spotwelding unsuitable—such as X4130 or 4140 steel. Because of the marked reaction of these air hardening steels, with resultant shrinkage and extreme *thermal* stresses, formation of sound and uniform spots would not be possible. Aluminum alloys and the stainless, low carbon, and other alloy steels all lend themselves to satisfactory spotwelding. There is, however, a marked difference in the treatment of these materials.

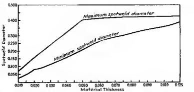


Fig. 1. Chart showing minimum and maximum spotweld diameter for various material thicknesses.

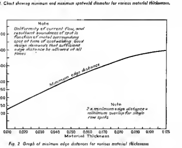


Fig. 2. Graph of minimum edge distances for various material thicknesses

During the past few years, spotwelding of attaching plates or lugs to armor plate has been accomplished with considerable success. Because of the achievement in this field, many spotweld technicians believe that with research and development many more alloy steels could be spotwelded—a phase now being actively explored, and a specific subject of investigation at the Ryan.

Materials having resistance of equal value can be spotwelded even though their chemical composition is not the same, although it is preferable to weld materials of similar composition. With aluminum alloys we find that electrical resistance will vary according to chemical composition.

The thinnest sheet is the determining factor in developing strengths of the spotweld. For this reason, the designer must remember that a wide variation in sheet thicknesses is not desirable, because only a small proportion of total strength of the thicker member can be utilized. Holding gages as similar as possible allows for uniform penetration, rapid production, and tends to prevent critical spotwelding conditions. Ratio of 3½-to 1 thickness limits between two sheets should not be exceeded.

In the absence of a design manual, the designer should consult the production man for dimensions and clearances necessary to use existing spotwelding equipment. This is sound practice because, while gage combinations may be well within the capacity of the machine, sufficient head clearance must be allowed around electrodes so that holders and electrodes may enter the area to be spotwelded. Use of this information by the design engineer, together with spotweld diameter, edge distance, spot pattern, and spacing, will yield two fold results—sound design and increased production. Listed here, are some details, gathered from our com-

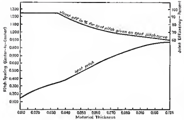


Fig. 3. Spotweld pitch and joint efficiency curves for single row pattern.

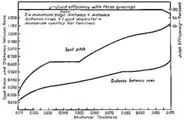


Fig. 4. Curves of spotweld pitch and distance between rows for two- and three-row patterns.

pany experience, of which the designer should have information:

1. Throat depth of spotwelder.
2. Distance between arms.
3. Diameter of electrode holders.
4. Dimensions and shapes of standard electrodes commonly used by the production department.
5. Angular set-ups possible on machines available.
6. Special electrodes available.
7. Minimum and maximum clearances required by production for the fabrication of channels, hat sections, Z-bars, and others.

While it is not contended that spot welding is an all-purpose method of manufacturing, there are, nevertheless, many cases in which spotwelding can replace rivets in lightly stressed assemblies. In some instances, the substitution can be made direct, while in others, a slight modification in the design of the part may be required. Where redesign is indicated, increased production and decreased cost will most certainly offset expense incurred.

Because of the high electrical conductivity and rapid heat transfer which is characteristic of aluminum alloys, extreme care must be taken in preparation for spotwelding—surface cleanliness being one of the primary requisites for consistent results.

Cleaning operation will vary, depending upon material. Principal function of this step is to remove oils, greases, and contaminants—particularly those whose electrical resistance would prevent a uniform current flow through the material. Considerable literature has been written concerning most suitable cleaning methods, hence only a brief general discussion will be included here.

Roughly, the cleaning is divided into two general types:

1. Mechanical brushing, in which steel or wire brushes or, in some cases, rubber bonded abrasive wheels, will lightly polish the surface of the material in the welded area. Initial cost of this equipment is rather low, although labor cost is somewhat expensive. Because of the difficulty of obtaining consistently uniform results, and danger of removing the protective layer of aluminum from Alclad, this method has not achieved general use.

2. Chemical solutions. A wide variety of chemical solutions are available, all of which essentially perform the following functions:

Removal of oil and grease (Step 1), rinsing (Step 2), removal of oxide and establishing a uniform surface (Step 3), and rinsing and drying (Step 4).

Stainless steels (18-8 type) may be satisfactorily cleaned for spotwelding by annealing, followed by chemical pickle and rinsing, or in the event parts are oily or greasy, by removal of oils and greases, followed by rinsing and then light acid etching.

Steel parts which have been sandblasted present a surface which renders them unsuitable for spotwelding because a certain amount of silica from the sand is embedded in the metal surface and these particles offer considerable resistance to electrical current flow, this "by-passing" seriously affecting spotweld consistency; also, the sandblasted surface prevents development of a uniform electrical contact and current flow, so that the spotweld formed varies in strength and is usually below minimum requirements.

Sandblasted parts can be prepared for spotwelding by annealing at a scaling temperature, followed by a regular chemical pickle for stainless steel. In some instances of severe sandblasting it may be necessary to scale and pickle the parts twice.

Following cleaning and drying of parts, next general operation is assembly. Because assemblies are normally handled by the spotwelder and his helper, small assemblies are the rule, and weight is usually limited. Assemblies are secured by either spot-tacking or with Cleco fasteners or clamps.

Considerable difficulty can be caused for the spotwelder if assemblies are not handled so as to keep them clean. Chips lodged between sheets, also oils, greases, and general contaminants which can mar the surface of these parts during assembly, can cause trouble.

Aircraft Acoustical Problems And Possible Solutions

PART IV*

By K. R. JACKMAN
Chief Test Engineer,
Consolidated Vultee Aircraft Corp.
San Diego

Concluding this important series covering a "must" item for future design, Author Jackman cites results of lightplane and jet aircraft noise surveys and points to standards of comfort and luxury for tomorrow's aircraft.

Noise produced by small planes at airports and over residential districts is today a matter of grave concern. To provide some criteria with which to judge current private plane noise levels, Krieger, Harrison, and the writer have made several recent surveys shown in Fig. 37.

A standardized procedure has been adopted at Convair to make noise octave-band analyses at a 25-ft. distance from the centerline of the plane and on a 25-ft. radius about the nose and tail. Thus the noise intensity at a certain frequency on a test plane can be directly compared to a previous test, the reflectivity of the ground being assumed approximately the same in both tests.

While the Ryan FR-1 Fireball does not belong in the lightplane class, nevertheless there has been so much discussion concerning the acoustical benefits in use of small jets in personal aircraft that the writer believes the public should be familiar with this new source of auditory annoyance. Fig. 38 shows the noise spectra existing in and around this new plane at several combinations of speed of the R-1820 reciprocating engine in the nose and of the General Electric I-16 jet engine in the tail.

It will be noticed that the predominant energy component has moved out of the 0-150 cycle region of the reciprocating engine to the 300-600 cycle octave on the jet. The high-frequency components of jet noise are "very annoying" and may be a new concern to acoustical engineers. The overall level on this craft using the nose reciprocating engine only at 1800 rpm is 107 db at a position corresponding to a wing engine, viewed from a rear

* Based on paper presented before ASME Aviation Section, Los Angeles, and Semi Annual Convention, Detroit.

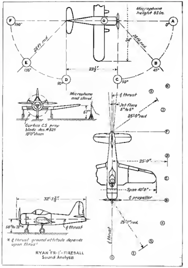


Fig. 37

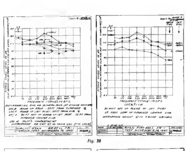


Fig 38

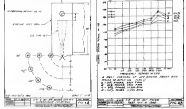


Fig 39

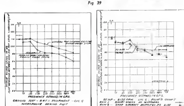


Fig 40

passenger cabin seat, whereas the noise of this same engine working with the I-16 jet at full rpm is 126 db The 1200-2400 cycle octave levels jump from 97 to 112 db in the two cases respectively This plane has no soundproofing and it is therefore not surprising that the pilots' compartment should indicate an overall level of 118 db, with the 1200-2400 cycle octave intensity at 96 db with both engines operating

Lightplane No. 1 in the test is one of the popular types and it is well to note that, in Fig 39A this small, untreated cabin indicates an overall level, on ground "warm-up" of 110 db at 1500 rpm and 115 db at 2150 rpm. The 1200-2400 cps octave levels were 89 and 97 db respectively Soundproofing would materially aid this pilot's cockpit, especially if some of the large rear window areas could be treated or covered with a soft absorbent material

Some Convair tests made upon Lightplane No 2 some months ago indicated a similar situation. The Solar Aircraft Co solicited Convair aid in determining the acoustical benefit of several Solar manifolds for 85-hp engines. Fig 39B indicates that the overall noise level of 109 db obtained with short stacks was relatively unaffected by the mufflers, probably because the predominant noise was largely due to the propeller. In the 1200-2400 cycle octave, however, a slight reduction from 93 db to 86 db was effected

To confuse still further the aircraft acoustical engineer looking for solace and silence to the jet of tomorrow, let a glance at Fig 40 and 41 assure him his troubles may just be beginning

At the request of the Solar Aircraft Co, Convair engineers made some measurements in their San Diego test cell of an Allison-built General Electric I-40 jet engine. Fig 40A shows the important microphone locations on this test and Fig 40B and 41 the noise levels taken inside and outside the test cell. Note the high intensity of noise level on Fig 40B existing in the test cell at Station 1, approximately 6 ft ahead of the exposed jet engine

This sound level varied from 124 db at 70% power to 137 db at 100% power at the 2400-4800 cycle octave. Undoubtedly the test cell reverberation added somewhat to this high noise intensity and in actual practice the normal cooling cowls and nacelle would muffle the high-frequency sound. Fig 41A indicates that as much as 128 db of overall noise may exist normal to, and 10 ft from, the tail pipe opening

The sound spectrum is almost flat, that is, almost pure "white noise". On Fig 41B may be seen the decrease of noise normal to the tail pipe exit from 127 db, to 122 db, and to 118 db with increasing distances of 10, 20, and 30 ft This just about checks the theory that sound decreases "inversely as the square of the distance." The noisiest place measured aft of the exhaust exit of the Fireball I-16 jet is at 157½ deg. from the forward axis of the plane, or 22½ deg. each side of the aft thrust line. The overall noise at this point was 125 db at a 30-ft distance.

Sound cabin tests would mean little if a method were not available to calibrate the "ground runs". The use of large two and four engined planes for flight tests are expensive, however, and only check tests are advisable on the completed article.

Fig 42A indicates the noise octave analyses obtained on an experimental plane when flown with no soundproof-

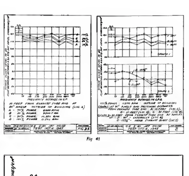


Fig 41

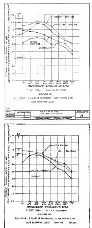


Fig 42

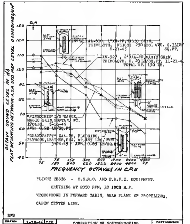


Fig 43

ing in the passenger cabin. The takeoff power of such a multi-engined transport gives some acoustical concern when it is realized that the 125 db overall, and 105 db at the 1200-2400 cycle octave, must be reduced to comfortable levels for airline use. Even the four propellers' windmilling caused 104 db of overall noise.

Fig. 42B indicates the difference that exists in the bare cabin noise level when the left or right inner engines are feathered. Removal of No. 2 propeller power, which in operation resulted in propeller "slap" high above the cabin floor, quieted the cabin approximately 6 db overall and throughout most of the octave spectrum, more than did the feathering of the No. 3 propeller, which applies impulses to the lower right cabin wall near the floor.

An interesting study has been made of several Convair C-87s, soundproofed during or after the War, with the results shown in Fig. 43. No attempt was made on any of the four planes to place the acoustical material installation foremost. Most of the soundproofing was incidental to other requirements or was a compromise to appearance or utility. In "Grandpappy", a "luxurity" model of the XB-24B, for instance, the use of leather and hard-surfaced interiors, together with the unprecedented use in aircraft of Pullman windows as seen in Fig. 44, caused the soundproofing weight to rise.

The slope of the "Grandpappy" acoustical curve of Fig. 43, however, from an overall level of 110 db at 2050 rpm cruise, to 96 db at the 75-150 cycle octave and to 67 db at the 1200-2400 cycle octave is difficult to meet, even on transports of considerably less horsepower. It will be noticed that similar Liberator type planes, with R-1830 engines operating at 2050 rpm cruise, indicated lower overall levels, but approximately 10 db higher noise level in the 1200-2400 cycle octave. "Grandpappy" was probably one of the quietest military craft of its power class.

To properly appraise the noise levels to be expected tomorrow in "luxurity" air transportation, that is, in air travel in which security has been combined with luxury in passenger comfort, one must know more about the actual noise levels existing in planes now being operated. Little objection is being made to the noise levels of current airliners at normal cruising speeds, so possibly today's noise spectrum may set the "comfort-yardstick" for tomorrow.

Convair recently cooperated with Western Air Lines in determining the noise spectra of several modern planes. A similar program is being worked out with other airlines to cover the major types of flying equipment. Fig. 45 gives some spectra, taken on the same basis, and using the same calibrated test equipment, used throughout this acoustical project. It is obvious that much intensive soundproofing research will be needed to permit doubling the horsepower and cruising speeds of tomorrow's planes and yet maintain today's airline comfort. And furthermore, we should aim to exceed this standard, possibly to compete in the railroad streamliner and bus transportation fields.

One fact is self-evident from this disclosure of test data. The acoustical engineer's field is becoming more important and he needs the cooperation of engineering preliminary designer, sales engineer, and management to prevent certain fundamental acoustical taboos. With the cooperation of the design department, he will still need a quick, economical method to prove his silencing ideas. The full-scale Convair Sound Cabin may be that stepping stone from the laboratory tests of the acoustical material manufacturers and college research groups to the practical flight airplane.

There is every reason to believe that Convair, by developing the Sound Cabin and having had the aid and advice of critics and of many acoustical engineers, in its adaptation to current flight problems, will effectively silence the Convair 240 this year and the larger Convair planes to come.

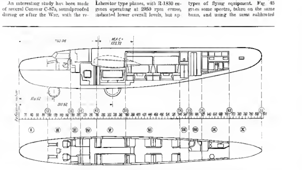


Fig. 44

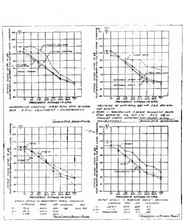


Fig. 45

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PRACTICAL ENGINEERING OF ROTARY WING AIRCRAFT

PART IV

Fig 1. Pitcairn PA-19 autogiro showing high dihedral in outer fixed wing panel to give lateral stability. Also seen are outboard fins and rudders.

Commencing with fundamentals for determination of correct balance and stability as obtained from tests and analyses of early autogiros, this presentation details the application of these concepts to latest types of rotorcraft.

By PAUL H. STANLEY

Chief Engineer

Autogiro Company of America

In Cierva's *Engineering Theory of the Autogiro* allowable balance variation are given, for this type of rotary wing aircraft, as an angle with respect to rotor centroid—rotor centerline of rotation at the plane of rotation. Since practical forms of rotorcraft must operate as an autogiro in event of power plant failure, the data obtained, over a number of years, on allowable balance variation for a number of different type autogiros is considered applicable to this entire category of rotary wing aircraft. All considerations of balance and stability will be treated here with relation to craft equipped with flexible types of rotors—for example, rotors having pivots or other means providing for blade motion transversely of the general rotational path.

In the older fixed-wing type autogiros, it was found that both the fixed wing and horizontal tail surfaces exerted an influence on allowable balance variation of these craft[1]. Limits of allowable balance variation were, for the tail-heavy condition, a slow, power-off, steady glide, with no tendency for the craft to get into a tail-slide or fall off to one side or the other, while, for the nose-heavy condition of balance, the craft was considered satisfactory if power-off landings could be effected at airspeeds of 40 mph. or less. Ref. 1 gives tabulated results of a number of tests, taking into account both the effect of fixed wing and tail surfaces. However, since the fixed-wing type autogiro is not now generally in use, it will be stated that an average angle between craft C.G. and rotor centroid of 1.9 deg. was found satisfactory for the tail heavy balance condition, while for the nose-heavy balance condition, this angle increased to 3.85 deg., the aircraft C.G. in both cases, being *ahead* of the rotor centerline of rotation. These average data are no theoretical values, but are derived from flight tests of different craft (eight for the tail-heavy balance; six for the nose-heavy balance), and were used in the design of fixed-wing autogiros of the early '30s, which accumulated many thousands of hours flying time.

In going to the wingless, or direct-control autogiro, the influence of fixed wing on autogiro balance was automatically eliminated, leaving only the location of aircraft C.G. with respect to rotor centroid as the main variable,

[1] All references collated at end of this article, page 77.

with horizontal tail surfaces having some secondary effect. (In experimentation with the first wingless autogiro of completely direct-control type, in early 1932, Cierva actually made a flight in a craft in which horizontal tail surfaces had been eliminated[2]. Power-off flight of single-rotor helicopters with torque-correcting rotor and no horizontal tail surfaces duplicates this early flight condition demonstrated as feasible by Cierva.) Tests on the wingless autogiro, with horizontal tail surfaces, of area approximately 1.25% rotor disk area, located 55 to 60% of rotor radius aft of C.G., and using the tilting hub for lateral and longitudinal control, established allowable limits of C.G. location with respect to rotor centroid as being of the order of 2.0 deg. ahead for tail-heavy and 6.0 deg. ahead for the nose-heavy balance condition.

While these limits were established for a tilting-hub control system, they are also considered applicable to rotary wing craft using cyclic pitch control, since the tilting hub and cyclic pitch control systems, in flexible types of rotors, are, for all practical purposes, aerodynamically equivalent[3]. A single-rotor helicopter without horizontal tail surfaces has been flown with C.G. from 38 min. to 3 deg. 18 min. ahead of rotor centroid. It has also been the experience that different pilots have different preferences for balance conditions in rotary wing aircraft, and for the direct-control autogiro with horizontal tail surfaces, an average location of 4 deg. ahead of rotor centroid has proved satisfactory. In the single-rotor helicopter, without horizontal tail surfaces, it is believed that an average C.G. location just under rotor centroid, with an allowable travel of ± 3 deg., would probably be satisfactory.

Longitudinal stability was achieved in the fixed-rotor, fixed wing autogiros by a combination of correct location of propeller thrust and proper choice and location of fixed wing. Cierva's studies on the subject of longitudinal stability in the autogiro, confirmed by a number of tests conducted by him in England, indicated that best stability would be attained when the propeller thrust line passed through the craft C.G. In experimental work conducted in America, this conclusion was confirmed 100%, hence it has become axiomatic that propeller thrust line pass through or close to the C.G., whether in fixed-wing or wingless autogiros.

Because weight of rotor and hub is a considerable distance above the fuselage, giving a C.G. location higher than in conventional aircraft, the result is that, when propeller thrust line passes through C.G., there is usually a tilt to the engine as mounted in the craft. The fixed wing type finally used incorporated an airfoil of unstable center-of-pressure travel (a Clark Y airfoil was used in the fixed wing of the PA-18 autogiro), located so that the most forward location of center of pressure was just at the most rearward location of aircraft C.G. In forward flight, with decreasing angle of attack on the fixed wing (but increasing total load), a substantial negative pitching moment was developed by this unit. This negative pitching moment not only counteracted the positive pitching moment from the rotor (as used in the fixed rotor autogiros), but left sufficient negative moment that the horizontal tail surfaces carried a small down-load. This down-load on the horizontal tail surface to give $\Sigma M = 0$ resulted in good longitudinal stability, that is, longitudinal stability was obtained through use of longitudinal dihedral, as in older types of fixed wing craft.

In the wingless type autogiro, it has been shown by a comprehensive series of tests conducted by at least two companies, that overall aircraft longitudinal stability is chiefly influenced by rotor blades themselves rather than by hub configuration or horizontal tail surfaces. In some of the earlier direct-control autogiros, an airfoil of markedly unstable center of pressure characteristics was used in the rotor blades. These characteristics—in conjunction with a considerable torsional deflection of rotor blade spar, tending to reduce blade pitch and give still greater negative moment in the blade in the advancing part of the phase angle $\psi = 0$ to 180 deg.—led to these craft having a tendency to stay in a dive, once this maneuver was initiated, with stick position beginning to move *aft* for an increased tip speed ratio once a certain critical tip speed ratio was exceeded. It was found that a cure for this unstable flight condition was the installation of a reflexed tab at the trailing edge of each blade tip, this unit completely reversing center-of-pressure travel from unstable to stable for the portion of the blade to which the tab was attached.

Fig. 2. View of Pitcairn PA-36 showing tail surface arrangement.

By varying reflex, and blade tip area which was reflexed, longitudinal stability could be changed to a considerable degree. In one craft on which the writer has data, it was found that with heavily reflexed trailing edge blade tips, the control stick could be left free, and a departure of 1 to 2 mph. from established flight speed would give a righting tendency which was very noticeable, especially since this machine had previously been flown with non-reflexed blades (but with an airfoil of low pitching moment coefficient). The amount of reflex used in this case had been overdone, since at 110-120 mph. forward speed, a 25- to 30-lb. push force was required on the control stick to hold the craft at these higher speeds. Modifications in the form of reducing reflex of the trailing edge at blade tips resulted in reduction of the high positive pitching moment of blades, reducing, in turn, the heavy push on the stick at higher speeds, and also the excessive longitudinal stability.

In rotary wing craft using cyclic pitch control, it is again important that torsional moments in blades be both small and of small variation with inh

Fig. 3. AC-35 autogiro with contra propeller.

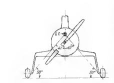

Fig. 4. Aircraft C. G. with respect to landing gear—front view

vidual blade angles of attack. The aerodynamic similarity of the tilting hub and cyclic pitch controlled rotary wing craft extends, in certain cases, to loads in the control systems. In each case, *variation* of torsional moment in individual blades with an increase of tip speed ratio results in a change of moment transferred to the control system in the form of a control stick load.

On the other hand, in the case of equal torsional moments in all blades (as at $\mu = 0$), the tilting hub, with the blades attached rigidly (in a torsional sense) to a hub member, also of high rigidity, transfers zero moment to the control system, since blade moments are balanced in the hub member; while in a craft using cyclic pitch control, with blades pivoted in a torsional sense, the sum of the torsional moments in the blade are transferred to the control system. And with a blade moment variation with change of tip speed ratio, giving high longitudinal stability, as noted above, control system loads in either type become excessive. The best combination to achieve longitudinal stability in any type of rotorcraft would probably be the use of an airfoil with a very slight positive pitching moment, used with horizontal tail surfaces of adequate moment. In the cyclic pitch control type craft, a considerable flapping hinge offset has indications of further improving longitudinal stability.

The problem of attaining lateral stability in the fixed wing autogiro was made more difficult by the relatively high C G of the craft with respect to fuselage side area, but this stability was quite satisfactorily attained through a combination of dihedral and upturned tips of the fixed wing. Experiments were conducted in which fin area was added to the craft just below the rotor, but while this expedient helped, it did not afford a complete solution to the problem. At this time Cierva investigated the problem and found the solution to be the addition of area at the tip of the fixed wing, with a dihedral of some 45 deg for the tip area. Since at a 45-deg dihedral the lateral component resulting from this tip area was fairly powerful, with its line of action considerably above the aircraft C G at the plane of symmetry, it was found that this was a complete solution to lateral stability in the fixed-wing autogiro.

A modification of the upturned tips of the fixed wing is that of a craft with the entire outer panel set on at some 15 deg dihedral—as in the PA-19 cabin autogiro (Fig. 1). Lateral stability of this aircraft was excellent, and the decision to use the simpler form of excessive dihedral only in the outer panel was occasioned by information on various dihedral effects, furnished by a member of the staff of MIT.

In the wingless autogiro, the problem of high C G with respect to fuselage side area was still present, but the possibility of lateral stability contribution from the fixed wing was absent. However, a differential horizontal tail surface of substantial area had been retained, and the first wingless autogiros carried upturned tips of some 45 deg dihedral on the horizontal tail surfaces. A number of wind tunnel and full scale experiments, both here and abroad, were conducted to find, for the wingless autogiro, that tail surface which would combine in a single arrangement the optimum for longitudinal, lateral, and directional stabilities. As a final answer to a rather costly investigation, it was found that the best combined set of tail surfaces was a differential horizontal tail surface of some 1.25% rotor disk area, located some 55 to 60% of rotor radius aft the aircraft C G, carrying at each tip, vertical surfaces tilted some 15 to 30 deg off the vertical, with a large central vertical fin and rudder (Fig. 2).

The differential referred to as incorporated in the horizontal tail surface of the wingless autogiro, was introduced for the primary purpose of reducing variation of lateral balance between the power-on and power-off conditions of flight. With elimination of the fixed wing, moment of inertia of the resulting craft had become very low about the *X* (or rolling) axis, with high sensitivity to propeller torque—especially in the case where a geared propeller was used. Also, the damping area contributed by the fixed wing was also completely eliminated. Cierva's analysis of this problem indicated that, if a differential of some ± 3 to 4 deg were incorporated in the horizontal tail surface, set to produce a torque about the X axis in opposition to the propeller torque, the race-rotation of the slip stream, in various power on conditions in conjunction with this differential setting, would practically counteract the propeller torque. In power off flight, the rolling moment produced by the differential tail was fairly well compensated by the lateral rotor moment (varying with speed), with any unbalanced moments, causing a roll, corrected by control stick movement.

An extended investigation[4] was conducted on the possibility of using contra-propellers[5,6] as a means of eliminating (or reducing) the differential required in the horizontal tail of wingless autogiros. It was realized that the introduction of the side area of a contra propeller just aft the propeller, on a tractor, would have an adverse effect on directional stability, hence it was necessary to design this installation in a manner to obtain the necessary contra-propeller blade area just aft the propeller disk, with a minimum of projected side area. Fig. 3 shows the installation as finally tested.

Tests were actually made with contra-propellers set 6 deg 40 min., and zero differential in the horizontal tail. However, best results with contra-propellers were obtained with a small amount of differential in the horizontal tail surface. As a part of this investigation, tests were made with variations in both planform and differential of the horizontal tail, resulting in the findings that: (a) Better results were obtained with a rectangular planform rather than a taper (from root to tip) in the horizontal tail, and (b) best results were obtained with the horizontal tail using approximately 50% of the original differential, and no contra propellers.

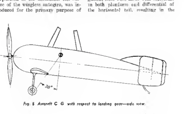

Fig. 5. Aircraft C. G. with respect to landing gear—side view

In steady flight throughout the speed range, there was less than 1 deg lateral hub inclination required between power-on and power-off, with no lateral travel at all in the power-off flight condition in the entire range of speeds tested. A final test of this craft (equipped with wooden propeller, gear ratio between engine and propeller being 1.408) was that of making a number of takeoffs at full power, and then cutting switches with the craft approximately 20 ft. in the air. It was found that this particularly unfavorable condition of torque variation was correctable by a 5-in. control stick movement, representing a 3.6 deg. lateral movement of the rotor hub. From this set of tests, additional specifications to differential horizontal tail area, as given previously, are that the area be of rectangular planform (of aspect ratio approximately 4) and that differential be of the order of ± 2 deg.

Necessity of obtaining a relatively high ground angle in the earlier autogiros resulted in a relatively short fuselage. This in turn resulted in directional instability in a number of the earlier designs, necessitating the addition of vertical fin area in the form of auxiliary fins attached to the horizontal stabilizer (see Fig. 1; also Figs. 4 and 5, Part I of this series, page 59, July 1945 AVIATION). In the wingless autogiro, after some of the tests on tail surface combinations referred to previously, it was found that the tilted auxiliary vertical surfaces, installed at the tips of the horizontal tail, in conjunction with the large central fin, gave adequate directional stability (Fig. 2). The G&A PA 39, one of the latest direct control, direct takeoff autogiros, is considered by many as the most successful of this type, with fair quantitative performance and good stabilities about all three axes.

Equations for the dynamic stability of a helicopter with hinged rotor blades have been derived[7], which, when used, lead to indications of dynamic instability (longitudinal and also probably lateral) in single-rotor 'copters. However, since the oscillations are of slow period, they can usually be damped by adequate controllability. For a laterally disposed twin-rotor machine (FW-61), Hohenemser's equations show lateral dynamic stability. It is therefore probable that twin-rotor tandem 'copters would show dynamic

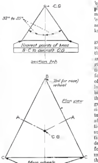

Fig. 6. Tip-over angle considered satisfactory for rotorcraft

longitudinal stability (if the factor of the rear rotor working in the downwash of the forward rotor does not contribute an unstable factor).

In the power-off operation of any 'copter—especially the single-rotor type—the state of operation is exactly that of an autogiro, hence it is logical to expect that various stabilities might be improved by the use of various elements of tail surface area found successful in the wingless autogiro, especially if the rotor would employ some form of torqueless drive (as in various jet-driven proposals), which would therefore eliminate the torque-correcting rotor. It is also considered by some qualified rotary wing engineers that the addition of a horizontal tail surface would improve present longitudinal stability of the hub-driven single-rotor 'copter with torque-correcting rotor.

Development work has been carried on for some years in investigation of designs of rotor hubs which would in themselves either give complete automatic stability, or improve stabilities already present. The two most promising of these developments are a continuation of work on the aerodynamically stable rotor system, commenced in England for the twin-rotor W-6 'copter (1936 to 1940), and further developed in the form of the floating hub[8] applied to a single-rotor two place 'copter by G & A Aircraft, and the application of means for attaining automatic stability by Bell Aircraft in their 'copter. Some proposals have also been advanced for incorporation of the well-known automatic pilot in rotorcraft.

One additional stability is usually given consideration in the design of rotorcraft—that of ground stability, that is, the relationship of aircraft C G and points of support on the ground given by the landing gear. Consideration of this factor was found necessary for a number of reasons—the high C G of this type craft, using conventional landing gear width, resulted in less stability to overturning than possessed by the conventional aircraft, and the low ground speeds on landing (with occasional side drift) would introduce overturning moments, when drift occurred, of a greater magnitude than in conventional craft. Overturning tendency resulting from drift landings was partially solved in 1934, and later by the development of a drift undercarriage for autogiros, in which the main landing gear wheels were so constructed that they were both steerable (attached to rudder controls) and had sufficient castoring so that in event of landing with drift, main wheels would automatically align themselves with the direction of craft movement on the ground. A further improvement in landing gears which would relieve side loads from drift landings was that of the tricycle landing gear with castoring front wheel.

As a criterion for arrangement of rotorcraft C G with respect to support provided by landing gear, the following was found to be satisfactory for direct control autogiros, and it is believed, will give satisfactory results for any rotary wing aircraft: As seen in Fig. 4, angle between ground contact and C G was of the order of 40 deg.; in Fig. 5 (aircraft in level-landing attitude) of the order of 30 deg., while in Fig. 6, tip-over angle should preferably be from 32 to 35 deg.

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FOR **BETTER DESIGN**

Compact Fuel Injection System Developed for Small Personal Craft

ELIMINATING DANGER of carburetor icing, Ex-Cell-O Corp's new fuel injection system is designed particularly for use on small aircraft engines. Standard equipment on Continental's 4-cyl. A65, C75, and C85 power plants, the injection installation is used on Culver's Model V, Fleet's Canuck, Commonwealth's Trimmer amphibian, and All American Aircraft's two-place side-by-side Ensign.

Reported for the system are positive control of fuel air mixture to afford reduced fuel consumption and improved engine performance, together with reduction of maximum cylinder head temperatures and attendant simplification of cooling system and cowling. Also claimed are better concealed wing and hull installations with the flat injection engine, and elimination of special ducting required for carburetor heat.

The injection system consists of four main components—pump, air throttle and linkage, discharge lines, and atomizing nozzles.

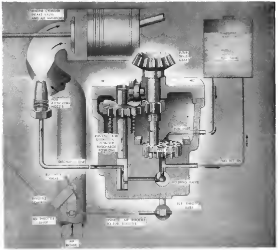
Pump installation comprises a supply pump, metering valve, and pumping and distributing plunger. The unit serves to supply correct amount of fuel and distribute it evenly, at timed intervals, under constant pressure through discharge lines to atomizing nozzles at each cylinder.

Metering valve in pump is linked to the air throttle lever on the air intake manifold. Both are calibrated to provide the exact fuel-air ratio required for optimum engine performance, and both operate in response to the throttle control lever. This provides a positive, constant control over the fuel-air mixture affording improved combustion and fuel efficiency.

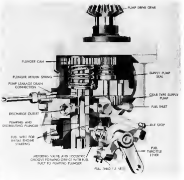
From the metering valve, fuel flows through a feed duct to the pumping and distributing plunger. This plunger, driven through gears at half crankshaft speed, operates in a steel sleeve and is supported in a roller which rests against a cam face on the upper side of the gear. Number of lobes on the cam corresponds to the number of engine cylinders and produces a plunger stroke of approximately 0.050 in.

Fuel enters the plunger through inlet ports that come into registry with the feed duct on the suction stroke. On the downward, or discharge, stroke, a discharge port in the plunger registers with an outlet port in the sleeve and the fuel passes on under pressure through a discharge line to an atomizing nozzle.

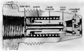
Atomizing nozzles are located in the air intake manifold just ahead of, and directed at, the intake valve of each engine cylinder. Nozzle body contains a valve, spring, and atomizing ducts. The valve—normally held in closed position by the spring—is forced down by fuel pressure to permit unrestricted passage to the atomizing ducts. Here, atomization is obtained by whirling the fuel in a central orifice, from which it is discharged into the air stream.

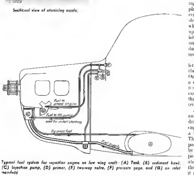


Flow diagram of Ex-Cell-O Corp.'s new fuel injection system.

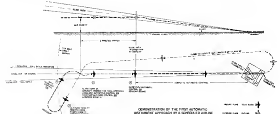


Sectional aspects of fuel injection pump


Sectional view of atomizing nozzle.



Typical fuel system for injection engine on low wing craft: (A) Tank, (B) sediment bowl, (C) injection pump, (D) primer, (E) two-way valve, (F) pressure gage, and (G) air inlet manifold.



Electronic Control Of Plane in Landing Approach

Techniques considered as new Sperry A-12 Gyropilot guides UAL DC-4 using VHF blind landing system . . . CAA installing automatic control-approach radio beacons.

In a recent demonstration at MacArthur Field, Seyville, L. I., a United Air Lines DC-4 made repeated approaches and simulated landings under complete control of the new Sperry A-12 electronic Gyropilot.

In line with this development, the CAA announced it is installing radio beacons that provide the bases for an automatic approach to the landing strip. The beacon equipment which CAA designates ILS (Instrument Landing System), is a civilian modification of the Army Signal Corps SCS-51 equipment. Two VHF radio transmitters provide a localizer and a glide path beam. The localizer transmitter is stationed at the far end of the runway on an extension of its center line. Glide path transmitter is near the edge of the approach end of the runway (illustrated in accompanying diagram).

Using the same technique as in radio range beacons, these two transmitters establish two planes in the air above the landing strip — one in line with the strip, the other along a glide path having a rate of descent of 300 ft./min. Using his receiver, the pilot can pick up and follow down the localizer and glide path beams as he follows the radio range signals.

To take full advantage of this approach service, UAL is installing the A-12 Gyropilots that operate from the receiver to guide the craft along the approach path established by the ILS beams. Control of the autopilot is by (1) gyros to provide directional sense, (2) an altimeter by which the plane can be automatically flown at the altitude at which the autopilot is thrown in, (3) the radio approach beacons, or (4) manually. The Gyropilot is a refinement of the A-5 used for precision bombing.

In operation, the pilot approaches landing beacons along any of the several standard routine patterns. When the receiver picks up the localizer beacon, the Gyropilot operates to center the plane at the intersection of the two lobes, one identified by its 90 cps. tone, the other by its 150 cps. tone. When the glide path beacon is reached, the Gyropilot also follows it. If there are cross winds, the Gyropilot brings the plane in at the necessary crab angle to follow the intersection of the localizer and glide path beams.

A course indicator shows the pilot the precision with which the Gyropilot is following the approach course. A verticle pointer (corresponding to the localizer on-course) and a horizontal pointer (corresponding to the glide path on-course) should be crossed over the small circle at the center of the indicator if the plane is to set its wheels down on the runway. It is anticipated that, although DC-4s have been landed by the autopilot, the automatic equipment will be used to bring transports down to 100 ft., the pilot taking over to actually put the plane down. Thus, planes will be able to land when airports are closed in with ceilings of only 100 ft.

Stratofreighter Cargo Hauler Designed by Boeing

By WELLWOOD E. BEALL, *Vice-Pres. Engineering and Sales, Boeing Aircraft Co.*

Latest adaptation of big Stratocruiser is 67½-ton high-speed goods carrier fitted with pressurization, refrigeration, and heating systems. It's planned to operate at 3c. per mile direct cost.

It was inevitable that Boeing should design the Stratofreighter, an all-cargo version of the Stratocruiser. The XC-97 military prototype of the Boeing Strato series was, after all, initially conceived and evolved in 1942 as a troop or cargo transport plane to implement the AAF dictum that there should be made available a transport companion to the B-29.

Considering the military logistics developing with use of global aircraft, the requirements laid down appeared to be drastic. Unusually large payload with high speed, high altitude and long range performance comparable with that of the Superfortress, and enough ruggedness to operate under the most primitive conditions and over the widest known variations of temperature and weather.

Boeing engineers found it possible to meet or exceed these specifications with the double-deck figure-8 configuration which, although 2½ times the B-29's volume, retained very favorable performance characteristics compared to those of the bomber.

Also included in the XC-97's basic design were complete pressurization, self-contained cargo handling devices, and maintenance and service features which reduced ground handling time.

Bearing in mind the tremendous increase in air cargo, a study was made of the possibilities of the XC-97 as a commercial air freighter. As a result of our calculations, we believe that the Stratofreighter can be operated at a direct cost of 3¢ per mile, and can carry a volume nearly twice that of the average railroad boxcar. Powered by four 3,500-hp. P&W R-4360 Wasp Majors, fitted with four-bladed Curtiss reversible pitch props, the 67½-ton craft will have a usable volume of 6,140 cu. ft., and will carry a maximum payload of 41,000 lb. at 300-350 mph.

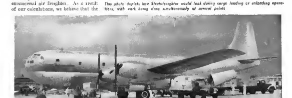
Among the Stratofreighter's features will be four cargo compartments, each separately accessible. Short haul cargo would be loaded into three lower deck holds at truck-bed level, while the long-distance load would be carried in the upper deck, 74 ft. 6 in. long.

Upper compartment would be loaded by means of an electrically powered hoist and crane through the clamshell doors at the rear underside of the airplane. Nearly 13 ft. long, 8 ft. 8 in. wide at the forward end and 5 ft. 11 in. wide at the rear, these doors would permit entrance of packages 6 ft. high, 6 ft. wide, and 15 ft. long. On the upper deck, the packages could be moved about by means of a powered overhead rail.

Either bin type loading or preloaded pallets could be utilized. Pressurization is to maintain sea level conditions up to 15,000 ft., and 6,000-ft. conditions at 25,000 ft. Also planned are thermostat-controlled refrigeration and heating systems, designed to function both on the ground and in flight. The heating unit will maintain 60 deg. F. temperature inside the fuselage despite outside readings as low as 67 deg. below zero F., while the refrigeration system will be capable of keeping the cabin at 45 deg. even though outside temperatures range as high as 100 deg. It would be possible to carry mixed cargoes, each requiring its own temperature levels.

GE BH-4 superchargers, would be standard equipment, their installation giving an estimated saving of up to 14% in fuel consumption at cruising altitudes.

This photo depicts how Stratofreighter would look during cargo loading or unloading operations, with work being done simultaneously at several points



Four-Seat Waco Aristocraft Is Novel Pusher

Company's first postwar offering is high performance monoplane of metal construction with fabric covering on fuselage only. Deliveries are set for early next year.

Representing a radical departure from any of the company's previous designs, the postwar Waco four-place Aristocraft monoplane contains several features of interest to both owners and to designers. As yet the Troy, Ohio, concern has not announced any price on the new craft although it is stated that fly-away-factory deliveries are scheduled for next February—almost 25 yrs. since the first Waco airplane was built.

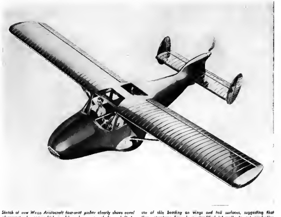
Most distinctive feature of the new Aristocraft undoubtedly is placement of an 84-in.-dia. Hartzell controllable pitch reversible prop aft of the tail surfaces. An extended drive shaft, utilizing Bendix-Weiss constant velocity universal joints in individual pressure lubricated housings, connects the airscrew to a 215 hp. 6-cyl. opposed Franklin aircooled engine. This power rating is for 2,500 rpm. at sea level, with cruising output of 161 hp. at 2,300 rpm. The engine is rubber-mounted, and cooling is by means of a blower.

Engine installation has been designed for handiness, with an auto-like cowling which is hinged at the top and raised simply by disengaging four external fasteners. Braces keep it in the open position. The engine compartment is stated to contain ample room for holding the battery. Two rubber-cell fuel tanks, of 60-gal. (80-octane) capacity are located one in each wing root and are gravity fed to a fuel pump supplying the pressure carburetor. A wet sump type oil system is used, with capacity of 3½ gal.

Advantages claimed for this unique propeller arrangement: Drag reduction by elimination of normal turbulence created by tractor prop, virtual elimination of prop noise in cabin, reduction of slipstream effects on control surfaces during power off and power on, and absence of propwash during loading or unloading or checking of engine.

Aileron and rudder controls are combined in the Aristocraft, with resultant movement restriction giving the craft spinproof characteristics. Twin control wheels are standard equipment. Foot

Lowness of craft to ground is noteworthy. Luggage compartment, of 16 cu. ft. capacity, is accessible from craft's interior as well as exterior. Landing gear is new self-contained Firestone unit with steerable nosewheel. Auto-type hood permits easy servicing.



Sketch of new Waco Aristocraft four-seat pusher clearly shows novel placement of prop, which is driven by means of long shaft to 215-hp. in-line Franklin engine in nose. Another interesting feature is use of skin beading on wings and tail surfaces, suggesting that these structures have been simplified internally to cut production time and costs.

Specifications and Data

Span	38 ft
Length	25 ft 8⅝ in
Height	7 ft. 8 in
Gross wing area	196.64 sq. ft.
Aileron area	42.06 sq. ft.
Stabilizer area	22 sq. ft.
Elevator area	16.41 sq. ft.
Rudder area (2)	7.5 sq. ft.
Fin area (2)	7.2 sq. ft.
Normal gross weight	3,000 lb
Maximum gross weight	3,130 lb
Weight empty	2,046 lb
Maximum disposable weight	1,084 lb
Normal disposal weight	954 lb
Baggage capacity	120 lb
Wing loading	15.25 lb./sq. ft
Power loading	13.95 lb./hp
Top speed (sea level)	154 mph
Cruising speed (sea level)	135 mph
Cruising speed (5,000 ft)	152 mph
Landing and takeoff speed	65 mph
Rate of climb (sea level)	950 fpm
Service ceiling	17,500 ft
Maximum range (sea level)	605 mi
Maximum range (5,000 ft)	657 mi
Fuel capacity	60 gal
Seating	4
Power	215-hp. Franklin

brake is located in the same place as an auto brake. The high wing position is said to afford optimum visibility. Center windshield panel and door panels are of safety glass, while all other transparent portions are acrylic resin. Access or egress is aided by use of two wide auto-type doors, and front seatbacks are hinged. Luggage compartment is accessible from inside and outside.

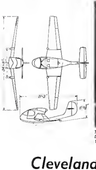
Performance figures are given as follows: Sea level top speed 154 mph., sea level cruising 135 mph., cruising at 5,000 ft. 152 mph., landing and takeoff speed 65 mph., stalling speed 55 mph., sea level maximum climb 950 fpm., service ceiling 17,500 ft., maximum range with 60 gal. of fuel 605 mi. at sea level or 657 mi. at 5,000 ft.

Spanning 38 ft., and with 25 ft. 8⅝-in. length and 7 ft. 8-in. height, this new Waco has a normal gross weight of 3,000 lb. and weight empty of 2,046 lb. Wing loading is 15.25 lb./sq. ft., and power loading is 13.95 lb./hp.

Wings, ailerons, stabilizer, rudders, and fins are all metal, but the fuselage is of tubular steel construction, fabric covered. Wings and stabilizer are of untapered rectangular planform, and a single strut braces each wing to main wheel housings.

Retractable tricycle landing gear is fitted, having a long wheelbase, and it's claimed that the craft's low C.G. permits crosswind landings of considerable severity. Gear is a pre-assembled Firestone unit designed to absorb landing loads by rubber displacement and air compression. The nosewheel, which is steerable on the ground by means of either control wheel, disengages in the air so as to reduce control forces.

Standard equipment for the Waco Aristocraft is listed as follows: Two-way radio, controllable-pitch reversible prop, airspeed indicator, compass, sensitive altimeter, bank-and-turn indicator, rate-of-climb indicator, clock, tachometer, oil pressure gage, oil temperature gage, fuel pressure gage, fuel capacity gage, ammeter, manifold pressure gage, cylinder head temperature gage, key lock ignition switch, instrument spotlights, and dome light.



This realistic radio-controlled scale model represents basic design of International Aviation's Duckling two-place amphibian which is slated for public showing next month. Grossing 1,500 lb full-size craft is expected to cruise at about 125 mph.

Cleveland Firm Developing Duckling Personal Amphib

Novel low-wing two-placer, now undergoing comprehensive scale-model testing, has been designed for low-cost large-unit automotive type production.

A NOVEL new personal amphibian, named the Duckling, is being scheduled by the International Aviation Corp., Cleveland, headed by Harrison R. Tucker. Although at the present time work is mainly confined to an extensive program of testing the design by means of various size flying scale radio controlled models, it's said that a full-size prototype will be ready for showing at the Cleveland National Aircraft Show in November.

Outstanding feature of the all-metal two-placer will be its special low-wing design, which will eliminate need of conventional wing tip floats or sponsons for on-the-water stability. Instead, the wing roots will be used as sponsons, being further aided by a fuselage of broad beam. This idea was tried during the war on several types of Navy seaplane gliders.

The Duckling will offer 52-in. seat width with adequate leg room for two 200-lb. passengers, tall baggage compartment, in which clothes will be hung up as in a closet, cockpit ahead of wing, giving good visibility during flight and taxiing, stall resistant and spinproof wing design; flaps; starter and generator as standard, toe brakes and parking brake, automatic bailing, cabin-door locks; mufflers to lower cabin noise level, flush door handles and cowling fasteners, glove and map compartment; Airfoam rubber cushions with spring backing, lock-type ignition, and carburetor air cleaner.

To span 34 ft. 8 in., have an overall length of 21 ft. 3 in., overall height of 6 ft. 9⅝ in., and 9 ft. 2 in. tread, the Duckling is planned for a cruising speed of approximately 125 mph. Gross weight will be about 1,500 lb., including a useful load of 500 lb. Design of tooling and jigs is being carried out to follow closely automotive methods. Design of the aircraft has not yet been frozen, pending further changes toward more economical production.

The company states that its radio control testing of large scale models of the Duckling prior to construction of a prototype is the first such program in development of a personal plane.

Initially this program consisted of determination of scale effects and trim reactions of flaps and various loading conditions. This was done by providing suitable electric control of throttle, landing gear retraction, and flap positions through the use of "U" control wires. These tests also included "emergency" belly landings, rough-ground landings, and checks of watertightness.

Then the models were put through a free-flight radio-controlled proving, made possible by installation of a miniature radio control system weighing but 2 lb. complete with servos and batteries. It's stated that the precision program included use of a ground control stick, spring loaded in such a way as to require more force for displacement as the amount of movement increases, thus providing a limited degree of "feel" to the system. This dynamic flight investigation program is by Tucker Aircraft Research Corp.

McDonnell, Firestone, and Bendix test craft display varied configurations and sizes. All are said to be forerunners of larger transport and personal rotory-wing craft.

Three Diverse 'Copters Make First Flights

1. McDonnell XHJD-1, built for Navy, is said to be world's first twin-engine helicopter to fly. Powered by two 450 hp. P&W Wasps mounted to pylons extending from fuselage to rotor hubs craft is said to cruise at 100 mph, carrying 3,000-lb. useful load. By means of a system of over-running clutches, single-engine flight is possible. Contra-rotating rotors are of 40 ft. dia., and rotor span from tip to tip is given as 91 ft. It's said that many variations in 'copter mechanisms and installations will be tested on XHJD-1. Company has laid out a commercial version of craft that is designed to carry ten passengers and crew of two, or a one-ton cargo load.

2. Firestone Model 45 is a civilian adaptation of G&A XR-9B (page 99, May AVIATION) and has been constructed to be flown extensively as a flying laboratory in preparation for design of a four-seat family 'copter. Powered by a four-cylinder 125-hp. engine, main rotor diameter of Model 45 is 30 ft. Overall height is 9 ft. 1 in., and length is 25 ft. 5 in. Dual controls are fitted in side-by-side-seat cabin, and Lucite enclosure is stated to permit 270-deg. visibility. Weight is less than half that of a low priced auto.

3. First photo of long-awaited Bendix helicopter depicts C. L. "Les" Morris flying a full-scale model test craft, designated Model K, for proving various mechanical arrangements and aerodynamic principles to be incorporated in company's nearly completed four-placer. Powered by 100-hp. Continental, Model K has 12-ft. 6-in. radius coaxial rotors and gross weight is given as 1,200 lb. including pilot and fuel. Rotor arrangement obviously allows for compact layout. Extensive testing has thus far included hundreds of air-hours since first flight on June 30, 1945.

Enormity of new Lockheed XR60-1 Constitution is illustrated by comparative size of interested spectators. Single tail rises over 50 ft. above ground. Craft is said to be 11 tons heavier than AAF's Douglas C-74 and 20 tons more than Navy's Martin JRM Mars. Retractable tricycle landing gear uses ten wheels, with four to each main strut. (U. S. Navy photo.)

Lockheed Unveils Constitution As Giant New Navy Transport

Twin-decked 168 passenger and freight carrier is designed for speedy hauling over long distances and features many in-flight maintenance installations.

CONTINUING the trend toward even bigger transports is Lockheed's latest—the 180-place double-deck Constitution—the first of which is now undergoing Navy tests as the XR60-1. That the craft has not yet reached its ultimate form may be noted in the announcement that included is a wing design which will permit installation of gas turbine power plants when they become available.

Four P&W R-4360 Wasp Majors, with a combined output of over 12,000 hp., enable the XR60-1 to carry a useful load of almost 35 tons of passengers and cargo. Grossing 92 tons, this giant has a span of 189 ft. and overall length of 156 ft., while the single rudder and fin tower more than 50 ft. above the ground.

Maximum ferrying range is given as over 6,000 mi., and top speed as 300 mph. In landing over a 50-ft. obstacle, the airplane is designed to stop in only 2,300 ft., and this distance may be further lessened when using the reversible pitch inboard propellers. Takeoff in calm air at sea level is stated possible after a run of 2,350 ft. at maximum gross weight. Minimum stalling speed is 80 mph.

Passengers may be carried in both decks, with the upper section fitted with seats for 92, and the lower deck (divided amidships by the wing) seating 76. Cargo space is set at 2,000 cu. ft. when carrying this total of 168 passengers, and 7,405 cu. ft. when the entire lower deck is utilized for freight. A crew of 12 is provided for.

Cabin is fully pressurized to maintain a 10,000 ft. pressure altitude at 25,000 ft., and included is the first large-plane installation of Minneapolis-Honeywell's Modnflow comfort temperature system. A galley is installed capable of serving 300 hot meals.

Among the Constitution's highlights is provision for in-flight maintenance of all engines and most mechanical, hydraulic, and electric fittings. Landing gear, wheel, and brake mechanisms are also said to be readily available in the air. In-flight lubrication of most mechanical parts is another service feature. A one-shot system permits lubricating oil to be pumped from a central tank to any engine nacelle.

For cargo handling efficiency, the XR60-1 is equipped with 10,000-lb. capacity hoists, while cargo doors, 106 in. x 74 in., permit easy loading of bulky items. Cargo flooring is designed for loads up to 300 lb./sq. ft. The forward cargo area is capable of stowing 60 ft. lengths of pipe or similar materials, or even fighter planes (with wings removed).

The retractable tricycle landing gear is fitted with four Goodrich-Hayes wheels to each main strut, and steerable Goodrich dual nosewheels.

Originally, the Navy placed orders with Lockheed for 50 Constitutions at a cost of $2,225,000 each, but when the war ended this contract was re-negotiated and now calls for delivery of two craft. It's estimated that these will cost the Navy approximately $27,000,000—including write-off of engineering, development, and tooling expenses.

Tap Those Sources Of Air Charter Business

PART IX OF A SERIES

By CHARLES A. PARKER, Flight Service Div., Robinson Aviation Inc., Teterboro Air Terminal, Teterboro, N. J.

In this practical approach to selling charter service, Author Parker presents a logical range of customer potentials, and outlines promotion means and policies pertinent to this special air function.

AT ITS BEST, charter or air taxi flying is a rather expensive means of transportation. Some operators are in a locality that by its very nature affords them a good possibility of selling air charter. In almost any city, there should be some charter business. It is often true that charter exists only if and when the operator goes after it. In some respects charter potentialities have been materially reduced with the advent of the extensive and wide spread airline activity. Yet there appears to be a substantial new interest emerging in postwar aviation in the matter of charter plane services.

In the past, some airplane service operators have built business around charter almost entirely. Usually, however, this service is part of some general flying operation. Charter business can be profitable business and is desirable to undertake. But to make much of it, a 4- or 5-place completely equipped plane is usually necessary. There seems to be potentialities for this purpose in some of the twin-engine, low-priced surplus military craft. And there is indication that some of the newer and more economical ships, such as the small Stinson 150, offer attractive possibilities for the charter operator and the tentative user.

Author Parker holds that some of newer and more economical craft give indication of offering attractive possibilities for air charter operation. Seen here is Stinson 150.

Was "One Time" Business

For the most part, prior to the war, charter proved to be "one time" business. Experience has shown that the number of people using charter as a steady diet was small, indeed. The one-time emergency, or unusual situation, that may justify a person paying 15-25¢ per mi. for transportation may seldom arise.

In developing charter, first step is to look for any unusual characteristics of one's environs that might afford a valid reason for people to use charter transportation. This may be present in a resort area, not served by the airlines, or at a recreational sports center located off the beaten path. Any area not served by airlines may produce an occasional trip to the nearest airline terminal.

Feeder Promotion

Charter sources: Those companies operating at airline terminals will find that a good source of business may lie in cultivating the cooperation of airline personnel. (In connection with this, incidentally, several attempts have been made to develop some type of nationwide cooperation between the airlines and charter operators. None of these, however, have succeeded in reaching the point where they have played much of a part in the air travel picture. Charter is still an individually conducted business—the service varying with the methods and nature of the operator conducting it.) From airline sources, there is the possibility of flying passengers to off-airline points, or bringing passengers from these points to airline terminals. Occasionally, a trip may be had from overflow traffic, or from the airline traveler who has missed his plane. Cooperative airline personnel, desiring to help their clien-

tele, as well as the operator, can be asked to suggest charter to points not served by scheduled lines.

With respect to emergency situations, the advantage of being generally known through advertising or other publicity may help. Often it is under this condition that the harassed individual will turn to the telephone directory for the name of an airplane service. Emergency business is entirely unpredictable, and in almost every city some emergency business should arise from time to time, each occasion adding to the grand total of activity.

Hospitals, doctors, clinics, are definitely worth contacting. Not too infrequently medical cases in remote points call for the services of a specialist and enable the airplane to render an important service and play a crowning role.

Sporting, hunting, and fishing meccas can usually be most conveniently reached by airplane. Hence, some contact among sportsmen may well show returns. There are aviation services to such areas that rely almost entirely upon charter operation as their principal source of income.

Various government enforcement agencies have used aircraft in apprehension of criminals.

Top executives who can afford to pay the price for special personal convenience in transportation may utilize charter aircraft, when they know that such services are conveniently located.

Another source of charter business is the travel agent or porter at hotels and clubs. Likewise, travel agencies should be contacted and asked to suggest charter when airline reservations are unobtainable, or when people ask for service to off-airline points. It pays to have a definite policy here of paying commissions for all such assistance.

In a small town, the operator can build the idea that he is the local aviation specialist and that people should turn to him for anything pertaining to aviation. Lending a helping hand on general inquiries and interests cannot help but direct attention to his business and may well lead to cash returns.

Press and photo associations frequently call for aircraft in the event of a news break at some distant point; hence, these activities should be contacted and good relations developed.

Practical promotion of air charter: For this function, repeated personal contact is basic, and may be supplemented by descriptive literature or a special folder distributed at such places as have already been mentioned, also to selected individuals whose names can be obtained in the manner described under the discussion of student development. And it may be advantageous to send out a small desk calendar or an occasional reminder in the form of a blotter.

One of the principal sources of charter business is to be known in those quarters where business can develop. Emergencies cannot be foreseen, but steps can be taken so that people will think of the operator when these situations arise. Some operators may be so advantageously located that they can stress air tour and sightseeing as much as point-to-point charter.

Charter can often be used as a spearhead for the introduction of other operator services. This is an important angle. An actual case in point is that of a charter lead, which upon being followed up, proved to be a prospect for an airplane. The man learned to fly at age 48 and spent nearly $10,000 for a new plane.

Finally, when selling charter, the salesman should not forget to stress the rigid regulations on ships and pilots, experience of personnel involved, and excellence of weather services.

Policies in conducting charter: Time saving is the important element that the charter operator has to offer—hence a delay should not be permitted, since it usually defeats the basic purpose of the trip. On charter flights reserved in advance, it is wise to take measures to prevent disappointment because of weather. Here, sufficient advance warning to the customer might allow for other alternatives, thereby retaining good-will.

Assistance on means of transportation at final destinations is all part of a complete service. To afford the ultimate in service, the progressive operator may go so far as to provide ground taxi service to the airport. If sufficient rates are charged for charter flying, the operator should not hesitate to provide occasional extras.

Before marketing any charter service, it is necessary to set up rate schedules. This may be for one craft, or several types as alternatives. Rates should be sound and the policy of sticking by them will assist in the maintenance of an effective sales policy. Flying times should also be specified, so that complete information is readily available.

Representative folders for introducing charter or air taxi service.

TAGGING THE BASES

First Region—Operation of Watertown, N. Y., $2,000,000 municipal airport was taken over by officials of Benson Watertown Airways, from Northern Air Service which has moved to its own field. . . . Allegheny County's $10,000,000 improvement of Greater Pittsburgh airport has started with $2,499,000 grading project. Grading will not be finished before Nov. Construction of $1,800,000 terminal building project is next. . . . Bradley Field, almost equidistant from Hartford and Springfield, Mass., is now being returned to State of Conn. Field has 3 runways, 300 ft wide and 1 mi long with space for extensions, 4 mi of paved taxiways and 400,000 gal underground fuel storage capacity. . . . N. Y. State Aviation Council, representing all flying interests in state, will hold first convention in Buffalo on Oct. 4 and 5. John W. Van Allen, v. p., is in charge of arrangements. . . . Springfield (Mass.) airport was purchased by Standard Air Service. Thomas V. Moriarty, Standard counsel, states company will continue to operate and improve field.

Second Region—J. S. Bellon and Albert McSorley, flight instructors at New Bern (N. C.) Aviation Co., Simmons-Knott airport, announced organization of Confederate Air Force. Starting with 60 student pilots, objective is formation of brotherhood of pilots below Mason-Dixon line, promotion of private flying and better airport facilities in South, and full cooperation with CAA and CAB. . . . Hawthorne Flying Service will establish complete airport service at Craig Field, Jacksonville, Fla. . . . 15 of 20 T-hangars are scheduled for construction. . . . Winston-Salem (N. C.) Joyce Flying Club has received charter from state. Incorporators: E. L. Fowler, A. R. Kirkman, and R. B. Shelton, all of Winston-Salem. . . . Eleven new private commercial fields are under construction in Ala.—in Atmore, Geneva, Jasper, Lanett, Mobile, Oneonta, Opelika, Phenix City, Robertsdale, Scottsboro and Sylacauga. Improvements are immediately planned for 16 fields. . . . Chattanooga Flying Club Team staged fourth annual National Airplane Trading Day Aug. 18 at city's Lovell Field. . . . Coastal Aviation Assn., Brunswick, Ga., has become permanent organization with James M. Conley as pres. Since founding last Fall organization has raised $7,500 for construction of new airport in Glynn County.

Third Region—Norton Field, 127-acre airport in Columbus, Ohio, was purchased by O. L. Parks, pres. of Parks Aircraft Sales & Service, E. St. Louis. Parks plans to renovate sales and administration buildings, improve field and erect individual T-hangars and showroom for plane sales. . . . Useleman Air Service, headed by Harry C. Useleman of St. Louis, distributor for Swift and dealer for Piper and Fairchild, has transferred from Kings Airport to Parks Metropolitan Airport, E. St. Louis. . . . Seymour (Wis.) Flying Club has been registered as corporation with A. Nelson as pres. . . . Lane Aviation Corp. has returned to Columbus municipal airport, offering 24-hr. service to civilian pilots. . . . Col. F. E. Evans, director of Mich. Dept. of Aeronautics, announces completion of seven airstrips northern peninsula. J. Sheldon is (?) manager. . . . Wis. Valley Airport, located 1 mi south of Rothschild, has been opened for air traffic. Owners, P. J. Reidy, Mrs. E. McNulty and D. C. Heldt, are giving flight instruction at airport. . . . Warsaw Aviation Corp., Warsaw, Ind., has been granted temporary month-to-month lease on Warsaw Municipal Airport, 2 mi north of city, east of Indiana State Road 15. . . . F. W. Williamson, agent, announces that $5,000 will be spent for development of airport. . . . New airport is under construction by R. Bedwell of Sullivan and E. Richards of Linton, Ind., on south side of Sullivan on 200-acre tract. Firm has three lightplanes for passenger service and instruction. Additional planes will be added, to be housed in 8-plane hangar. Another building will be constructed to house merchandise planes. Salvaged Army bomber has been remodeled as lunch room.

Fourth Region—At Stillwater, Okla., Convention National Flying Farmers Assn. elected F. Wilson, Thomas, Okla., pres.; W. E. Friell, Larned, Kan., v. p.; E. A. Hansen, Vernon Center, Minn., sec.-treas. . . . M. W. Dennery, New Orleans attorney, has been appointed to New Orleans Airport Commission to succeed G. S. Clarke, resigned. . . . Work has started on $80,000 addition to Houston, Tex., airport administration building for use by international traffic personnel. . . . Tucumcari, N. M., has leased municipal airport to C. Toth of Toth Aircraft & Accessories Co., Kansas City. Lease provides for Toth's erection of $10,000 administration building and $1,000 repair shop.

Fifth Region—Kansas State College, Manhattan, has started flight training courses

(Turn to page 142)

CAA Apportions Airport Sums

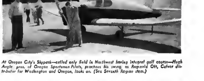
CAA has apportioned to the states, for 1947, $30,822,750 of the $500,000,000 federal aid awarded by Congress for airport construction and development during next 7 yr.

The half billion appropriation will build about one-fourth less than the 2,900 Class 1 and 2 fields CAA intended to construct with the $675,000,000 requested. Program provides for only approximately 100 transport fields.

Five percent ($25,000,000) of total fund goes for administration over the 7-yr. period; 25% ($118,750,000) is for allocation among the states at discretion of the Administrator; and balance of $356,250,000 is for allocation among the states, pro-rated 50% on area and 50% on population percentage to U. S. totals. Each state must match federal sum allocated to it.

Out of $45,000,000 appropriated for '47, $1,740,000 is for Alaska, Hawaii, and Puerto Rico, leaving U. S. $43,260,000 — which, less administrative and discretionary funds, is $30,822,750.

Regulations governing individual project requests are now being prepared, and applications from project sponsors are being considered.


At Oregon City's Skypark—called only field in Northwest having integral golf course—Hugh Angle, pres. of Oregon Sportsman Pilots, practices his swing as Reginald Ott, Culver distributor for Washington and Oregon, looks on. (See Seventh Region item.)

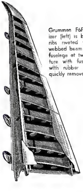
AS THE OPERATORS SEE IT

QUESTION 5 — After acquisition of aircraft and establishment of maintenance and hangar facilities, what fixed base improvement will constitute the best investment from viewpoint of customer appeal?—B. B.

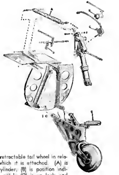
Answer: "After establishment of a well-stocked accessories store, which is a prime need, I believe that lounge facilities are next in importance. A few cheerful rooms, comfortably furnished and affording a good view of field through wide windows, are a great attraction for getting and holding flying customers. A sandwich bar is a necessary part of such a set-up and will pay dividends. Indoor sports facilities will pay off, too!"—*K. S.*

Readers are Invited to Answer

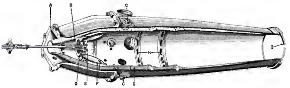
Question 6—Am contemplating installing a small luncheonette at my fixed base. Having had no previous experience in the food line, would it be to my advantage to operate this activity myself, or should I proposition an experienced eat shop owner in the community to set up a concession?—R. L.



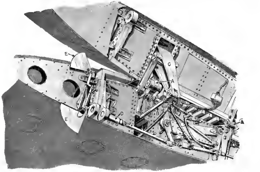
Grumman F6F Hellcat stabilizer (left) is built of stamped ribs riveted to single shear webbed beam and attaches to fuselage at two points. Juncture with fuselage is sealed with rubber edging. Tip is quickly removable.



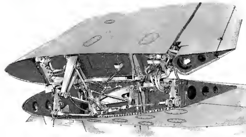
Exploded view of F6F retractable tail wheel in relation to bulkhead to which it is attached. (A) is hydraulic retracting cylinder; (B) is position indicator; (C) is warning switch; (D) is up lock; and (E) is wheel centering mechanism.



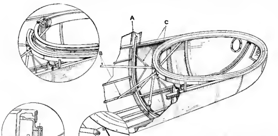
Cutaway view of de Havilland Goblin II turbojet combustion chamber which bolts to expansion chamber at (A) at upstream end. Concentric flame tube (B) is held in place by three pins—two of which are shown at (C)—that are attached to outer casing but allowed to slide in sockets in flame tube for radial expansion. Burner has swirler (D) around fuel nozzle (E) and metering holes in caps (F) through which approximately 20% of air from compressor enters combustion chamber. Remaining 80% goes through annulus (G) and is metered into chamber through ports (H). Downstream end of chamber is attached to nozzle junction by expansion joint (I).

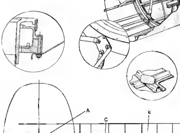


Wing folding mechanism of de Havilland Hornet, showing hinge points (A) of outer panel which swings up and over fuselage. Folding is accomplished hydraulically, with piston arm (B) actuating linkage (C). This piston has its hydraulic supply linked through sequence valves to locking pins (D). By a second lever which the pilot cannot operate until folding actuating lever has been moved, locking pins engage withdrawing pins, showing metal flags (E) unless locking pins are secure.

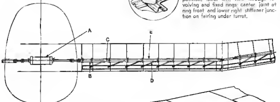


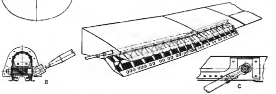
View from aft to rear spar of de Havilland Hornet revealing complete wing folding mechanism, and showing, just behind rear spar, method of making electric and hydraulic connections between center section and folding outer panel.





Aft gun turret details on Avro Lancaster: Mount attaches to former (A), tubes (B) giving extra support via tie-in to other former. Tubes (C) support walkway. Upper left: Details of revolving ring in position; lower left, view through revolving and fixed rings; center, joint at ring front and lower right stiffener junction on fairing under turret.





Diagrammatic layout (top) shows Lancaster flap installation, with hydraulic operating cylinder (A). Section through (B) is shown in enlarged sketch at lower left and detail at (C) is shown in enlarged sketch at lower right. Typical operating link (D) is shown connected to operating torque tube (E). Phantom (center) shows general construction and method of connecting torque tube installation and link.

SHEET NUMBER		*D-37 (Continued)*
CLASSIFICATION		*Processes*
SUB CLASSIFICATION		*Quantities*

Conversion Factors (General)

PART II

Unit	Multiplied by	Equals
Ft -lb	1285×10	Btu.
Ft -lb	1356×10^{7}	Ergs
Ft -lb	0 13825	Kg m.
Gal (U S)	0 1337	Cu. ft.
Gal (U S)	231	Cu in.
Gal (U S)	0 833	Gal (Brit.)
Gal (U S)	3 7854	L.
Gal (U S)	128	Oz (U S fl)
Gal (U S)	8 3378	Lb. Av. water—62°F.
Grain	64 799	Mg
Gm.	15 432	Grains
Gm.	0 03527	Oz. Av.
Gm	2.205×10^{-3}	Lb Av.
Gm wt.	980 665	Dynes (at G.)
Gm cal	3.968×10^{-3}	Btu.
Gm cal.	3 087	Ft -lb.
Gm cal.	0 4267	Kg m.
Gm cal	4 184	Joules
Gm cal./gm.	1.8	Btu /lb.
Gm cal./gm /°C.	1	Btu /lb /°F
Gm. cal /sq cm /sec./cm./°C.	0 80620	Btu /sq ft./sec./in./°F.
Gm./cu. cm.	62 43	Lb /cu ft.
Gm /cu. cm.	0 03613	Lb./cu. in.
Gm./l.	0 1335	Oz gal.
Gm /l.	0 008345	Lb gal.
Gm. sq cm.	0 01422	Psi
Gravitation constant	6.66×10^{-8}	Dynes
Gravity	980 665	Cm /sec /sec.
Gravity	32 174	Ft sec /sec.
Hp (U. S.)	33,000	Ft -lb /min.
Hp (U. S.)	0 7460	Kw.
In	2 5400	Cm.
In	1000	Mils
Int ann Cu std.	1 7241	Micro /cm cu (68°F.)
Int ann Cu std.	0 15328	Ohm M gm (68°F.)
Int ann. Cu. std.	10.371	Ohm/mil-ft.
Joules	1	W sec.
Joules	0 23889	Cal
Joules	10^{7}	Ergs
Kg	2 20462	Lb Av.
Kg	0.001	Metric ton
Kg. cal.	3 9685	Btu
Kg. cal.	1000	Gm. cal.
Kg. cal.	3087 4	Ft -lb.
Kg. cal.	427 0	Kg m.

Courtesy Reinhold Pub. Corp., *Metals & Alloys Data Book*, by S L. Hoyt.

By ELTON H. BROWN, JR.

Registered Patent Agent

Following are digests of some of the more interesting patents on aviation developments granted through the U. S. Patent Office. Mr. Brown will be happy to answer questions on patents for the reader. Address inquiries to him, care AVIATION, 330 West 42nd St., New York 18, N. Y. Printed copies of any patents listed are obtainable at a cost of 25¢ each, directly from U. S. Patent Office, Washington, D. C.

Towing System, intended for use with plurality of powered craft or gliders, features tow lines to actuate control surfaces of towed craft in synchronization with actuation of control surfaces of towing craft. Locks are also provided to prevent displacement of control surface setting in each adjusted position.—2,400,400, filed Dec. 14, '42, pat. May 14, '46. J. Van B. Duer, assignor to Pennsylvania Railroad Co.

Shield Assembly, intended to minimize icing in and around air scoop mouth, comprises streamlined bulbous member constructed of coarse mesh screen in front and fine screen at rear, the unit being positioned adjacent to and in front of scoop. Ice first forms on small screen, then on large screen, thus completely covering shield, which then acts to deflect ice or water particles away from intake while air stream, having little inertia, is directly over shield trailing portion into scoop.—2,399,180, filed Oct. 14, '43, pat. Apr. 30, '46. W. H. Hunter, assignor to B. F. Goodrich Co.

Glider adapted to be towed or carried, has fuselage compartmentation for radio control equipment, servo motors, batteries, auxiliary fuel tank, bomb, torpedo and flare and smoke screen material, together with means for releasing some of material from compartments. Craft may be used as auxiliary fueler, as a bomb by action of fuselage falling free, or as a glide bomber, and may be landed by self-contained controls or via control from tow plane.—2,399,215, filed Aug. 16, '41, pat. Apr. 30, '46. D. S. Fahrney. Designed by same inventor, flying aircraft carrier has trapeze installation which is adaptable during flight to receive or launch small planes. Wing recesses are used for nesting carried craft.—2,399,216, filed Oct. 10, '41, pat. Apr. 30, '46.

Spinner Assembly designed to protect hub portion of propeller while maintaining aerodynamic characteristics, consists of flexible cone-shaped cover inflatable to provide streamline shape and break up ice formation. Electrical heating means are also included to assist in ice removal.—2,401,247, filed Sept. 20, '41, pat. May 28, '46. W. H. Hunter, assignor to B. F. Goodrich Co.

Pressurized Aircraft Conduit, serving as passage between fuselage compartments separated by non-pressurized area, has form of flexible tubular section collapsible when not in use and readily expandable when compartments are pressurized. A trackway and carriage are provided within the conduit to facilitate passage of cargo.—2,403,595, filed Dec. 31, '42, pat. July 9, '46. H. K. Growald, assignor to Consolidated Vultee Aircraft Corp.

Puncture Sealing Lining for fuel tanks has 2 in. layer of annilled deposited rubber latex, inner coating of Neoprene or similar non-reactive rubber, and at least two layers of cord fabric adhering to outer surface of latex, cords of one fabric being set at an angle to cords of other fabric, both fabrics being vulcanized together.—2,401,027, filed May 10, '41, pat. June 4, '46. E. Eger, assignor to United States Rubber Co.

Dive Bombing Sight comprises sighting device adjustable angularly in vertical plane for fix on target and horizon sighting device with adjustability for fix on horizon. Target sight has limited position offset above line parallel to craft axis by angle equal to lift angle when in vertical dive. Horizon sight is offset back of vertical to axis by equal angle. Both sighting devices are connected by adjustable ratio linkage suitable to operate in accordance with functions of predetermined airspeed and altitude.—2,401,744, filed June 21, '39, pat. June 11, '46. M. E. Browder and A. Wertheimer.

Aircraft Seat Support Structure is designed to take up shock of crash landings and protect occupant from being thrown forward violently. Mount is sufficiently strong to withstand normal landings, but breaks on shock landings and resilient device takes up shock load gradually as seat moves forward after breaking loose.—2,401,748, filed Oct. 17, '44, pat. June 11, '46. F. P. Dillon.

Airfoil Control Mechanism for main and auxiliary surface coordination is adjustable to cause auxiliary unit to lag, lead, or move at same rate as main airfoil. Within limits, degree of relative movement between units may be varied at will with respect to predetermined main unit movement.—2,401,790, filed Jan. 16, '44, pat. June 11, '46. J. Noyes, Jr. and M. L. Daggett, Jr., assignors to Curtiss-Wright Corp.

GERMAN PATENTS AVAILABLE

More than 100,000 seized German patents are to be made available on royalty free license to those nations which signed recent London patent accord. According to Alien Property Custodian, approximately 15,000 patents held by U. S. will be available to business organizations in Britain, Holland, and France, and patents held by those countries will be offered for use in U. S.

Aerial Torpedo, adapted to be launched from carrier airplane, is provided with a detachable airframe with wings and empennage for gliding into target area. Trailing paravane strikes water first, operating latch to release airframe from torpedo prior to latter entering water.—2,401,853, filed June 23, '41, pat. June 11, '46. R. A. Bailey, assignor to Lockheed Aircraft Corp.

Helicopter Speed Reduction Gearing, for interposition in drive transmission line for oppositely turning coaxial lifting rotors, employs two groups of planetary gears and freely rotative plate interconnecting respective planetary groups in such manner that power may be transmitted from one group to other and differentially balanced so as to provide equal torque to internal gears of respective groups regardless of their speed rotation.—2,402,043, filed July 31, '43, pat. June 11, '46. R. R. Hays.

Stick Aileron Control System is designed to provide connection between these units to afford requisite dwell positions in operation of each aileron. Connections are reversible in sense of transmitting to control stick, portion of aerodynamic forces encountered by ailerons, so as to make these forces perceptible to pilot.—2,402,091, filed Mar. 15, '41, pat. June 11, '46. E. F. Zap.

Cargo Plane, particularly adaptable for automobile hauling, features fuselage with rear loading door and system of movable ramps or tracks for guiding cars to storage positions arranged at various elevations and angles, thus utilizing entire available space.—2,402,283, filed Nov. 18, '41, pat. June 18, '46. F. L. Hewitt, assignor to Overlakes Freight Corp.

Indicator designed to continuously show wing loading, in terms of gross weight, during level flight is operated by differential pressure taken from vertically displaced ports on upper and lower wing surfaces at position aft of leading edge so that pressure differential is independent of airspeed.—2,402,618, filed Apr. 16, '45, pat. June 25, '46. J. Platt.

Flyer's Boot consisting of outer shoe and inner slipper fixed by snap elements against relative displacement, features heating elements secured to flexible asbestos mounting strips to permit adjustment of elements to wearer's requirements.—2,402,726, filed Oct. 15, '43, pat. June 25, '46. E. M. Donyhady.

Propeller Anti-Icer comprises electric heating element located in blade interior, contact being provided through slip rings which permit pitch adjustment without removal of wiring.—2,402,779, filed Aug. 21, '43, pat. June 25, '46. C. A. Paškel, assignor to Curtiss-Wright Corp.

Wing, incorporating boundary layer control, is provided with blower for producing flow through wing slot, control being arranged to effect increase in pitch of blower blades accompanied by decrease in propeller blade pitch at time maximum lift is desired, as in landing.—2,403,133, filed Oct. 13, '43, pat. July 2, '46. E. A. Stalker.

Cockpit Canopy designed to permit rapid jettisoning is mounted for sliding movement on trackway, carriage being fitted with spring operated release for separating canopy and carriage via trigger.—2,403,250, filed Dec. 11, '42, pat. July 2, '46. C. M. Verhagen, assignor to Adlake Co.

Recent Books

AIRCRAFT DRAFTING, by Hyman Katz. Macmillan Co., N. Y. C. 386 pages, illustrated. $5.00

This book provides essential training and information for aircraft draftsmen, with much data that will be constantly useful for reference on job. Technique, procedure, and practice of lofting is explained in some detail. Moreover useful information is given on change groups, bills of materials and weight calculations.

AIR TRAVEL GUIDE TO LATIN AMERICA, by Ivan Bullot. Franklin Watts, Inc., N. Y. C. $5.00.

Main body of this work comprises guide to countries of Latin America, with latest vital statistics, detailed maps, descriptions of high spots in principal cities—hotels, places of entertainment, important shopping centers, sightseeing expeditions, important dates and events, popular vacation resorts, and a great many other facts useful to air traveler.

WELDING MANUAL. Reynolds Metals Co., 2500 S. Third St., Louisville, Ky. 87 pages, illustrated. $1.00

Gas welding, arc welding, resistance welding, brazing and soldering are principal headings in this booklet intended to provide aluminum users with a comprehensive resume of latest practices and recommendations for joining aluminum by these processes.

HOW TO CONDUCT CONFERENCES, by Alfred M. Cooper. McGraw Hill Book Co., N. Y. C. Second edition, 207 pages, $2.00.

This edition outlines the development of workable conference plan, the application of group meditation and methods by which the conference leader may conduct successful meetings—with business, educational, government, or civic groups. It aims to enable reader to make the conference an efficient tool for solving problems and getting things done. Included

(Turn to page 141)

OUR ATTENDANCE at the National Air Races this year was limited to part of one of the radio broadcasts. That one was plenty. It consisted of the usual unctious announcers bucking the microphones around to each other to catch the deathless words of bored celebrities, to get a word picture from somewhere else—you know how it goes.

But the stopper came from the lad covering the jet division of the Thompson Trophy race. After a lot of breathlessly vague description he concluded that the jet planes weren't quite ready to start because "I can't see the propellers turning yet."

• What we really want to listen to, though, is the broadcast of the first drone race. Can't you just hear the announcer enthuse:

"Well, folks, here we are in the control room of the Thompson Drone Race. Well, folks, it's nice and cool here—air conditioned—so we're comfortable, aren't we? But the thousands and thousands of people out there in the stands—well, we sure pity them, don't we. Well, folks, the pilots are all lined up in their control chairs. Over there in the pole position, just as cool as a cucumber, if I may coin a phrase, ha, ha, is Joe Blow. Joe, you know is the outstanding young man who last week flew from Hollywood to Miami upside down. Next to him in No. 2 position is Herman Kilroy—and believe it or not, folks, he isn't hanging over the control panel by his nose. Ha, ha. Kilroy, you know is substituting for Charlie Blatherwitz, whose control finger was so severely injured last night as he worked over his panel that he couldn't compete today. (Actually Charlie got his finger caught in a slot machine in a bar). And in No 3 position is petite Cloudy Day, the first girl ever to finger this race. And now, folks, the judges indicate that everything is ready, we can see the planes out on the line all ready to go—and there, the start signal is given. They're off! Whoa, wait a minute, something seems to be wrong . . . er . . . uh . . . yes, that's right, something's wrong, the planes are still there on the line. Just a minute now, folks, we'll find out what happened. Oh, Harry! Harry's our technical expert, folks, and he'll have the answer for you in just a minute. What's that you say, Harry? Well, well, folks, what do you think of that—somebody forgot to turn the power on for the pilots' transmitters and they just don't have any control over the planes. But, our time's up now—the Bla Bla Broadcasting Company will now take you to Billy Stinkeroo and his Swingeroo Orchestra for fifteen minutes of stuff and things. So, this is Dickie Dope who almost brought you a description of the first Thompson Drone Race saying so long until this time next year. Happy landings!"

• When the young Southern bride went up to damyankee territory to set up housekeeping with her engineer husband, she took along her faithful Negro mammy. Now mammy knew all there was to know about fried chicken and things, but her knowledge of matters aeronautical was, to say the least, limited. So the groom took her out to the plant and gave her a good, thorough inspection of both planes and helicopters. When he got home for dinner that night he asked if she was now certain she knew the difference between an airplane and a helicopter.

"I sho' do, mistah. That helicopterthing is the one that's the *mos' peculiah*".

• Interchangeability of parts between airplanes of the same model is, we're fully convinced, just a starting point. Now comes interchangeability not only with other planes, but even with other industries. A handout announcing a new plastic material says it is adaptable to such uses as office paneling, decorative fittings in night clubs and—so help us—"windows for airplanes and washrooms."

"Maguire's almost gone nuts trying to get his 'Sh-Sh' plane ready for the show!"

THE AVIATION NEWS

BLAINE STUBBLEFIELD, Washington HERB POWELL New York E. J. BULBAN, New York

Need for Important Legislative Action Is Evidenced as Facing Incoming Congress

. . . Cosmic ray study made . . . Telemetering demonstrated . . . FLC plane sales tallied . . . Cuts affect AAF, Navy . . . Missile program unsettled . . . CAB reveals accident score . . . Fireproofing ordered

Only two major actions on aviation were taken by the 79th Congress—$1,000,000 000 Federal aid airport measure and ratification by Senate of the International Civil Aviation Convention drafted at Chicago in 1944 The Convention which commits the U S to membership in a permanent ICA group lay pigeonholed in Senate Foreign Relations Committee a year-and-a-half and was reported only after the President protested

Lacking groundwork of future military organization Congress failed also to modernize aircraft procurement procedures, did not repeal obsolete provisions of the Vinson-Trammel Act, setting 12% profit ceiling on naval aircraft contracts and requiring Navy to manufacture 10% of its planes at its Philadelphia plant

House Interstate Foreign Commerce and Senate Interstate Commerce Committees recognized need for basic legislation in transportation establishing relation between air and surface House committee ordered a study by Dr John Frederick of Maryland University for presentation to 80th Congress Similar step in Senate was blocked by wrangle between Interstate and Commerce Committees Latter however will be merged into Interstate & Foreign Commerce Committee as result of Congressional reorganization.

In a last minute rush, Congress enacted the 5¢ airmail bill, awarded special medal to Gen Billy Mitchell authorized an air museum at Smithsonian Institution, directed CAA and Weather Bureau to expand services to include international air transport, and authorized Office of Research for the Navy House passed air parcel post bill, and in the Senate, the Kilgore-Magnuson bill for National Research Foundation was passed also the authorization of $12,000-000 for air facilities at Annapolis

All unpassed bills die with the 79th Congress They can be taken up "as was" but any necessary promotion has to be repeated

NACA ROCKET MISSILE TAKES OFF

Two stage guided missile developed by NACA sweeps into air, with smoke pouring from booster unit used to gain initial near sonic speed Rear tail assembly drops off when first six rockets are expended, then main power plant in missile's forward section takes over to impel weapon at supersonic velocity

★ COMING UP ★

Oct. 1 PICAO Middle East Regional Air Navigation Meeting Cairo Egypt
Oct. 3-5 SAE National Aero Meeting & Aircraft Engineering Display Biltmore Hotel Los Angeles
Oct. 4-5 New York State Aviation Council annual meeting, Buffalo
Oct 4-13 Annual Air Show sponsored by Aircraft Industries Association Cleveland
Oct. 5-20 State Fair of Texas with exhibit on aircraft parts & accessories sponsored by Southwest Airmotive, Petroleum Bldg., Tex.
Oct. 10-12 ASTE semi-annual convention Pittsburgh.
Oct. 12 Oakland, Calif, Air Show
Oct 14-17 National Aviation Clinic Oklahoma City
Oct. 16-17 SAE National Transportation & Maintenance Meeting Hotel Knickerbocker Chicago
Oct. 19-21 Third annual Aviada, Las Vegas, Nev
Oct. 23-25 Second Annual Arizona Aviation Conference, Phoenix Ariz.
Oct 24 IAS Air Transport Meeting at Statler Hotel, Washington D C
Oct 29 Annual meeting International Air Transport Association Cairo Egypt
Oct 29 PICAO Meteorological Div resumes, Montreal
Oct. 30 PICAO Special Radio Technical Div to convene Montreal
Nov. 7-8 SAE National Fuels & Lubricants Meeting Mayo Hotel, Tulsa, Okla
Nov 8-11 Northwest Aircraft Show Vancouver Wash.
Nov 15-24 National Aircraft Show sponsored by AIA, former Fisher Bomber Plant, Cleveland
Nov. 19 PICAO Communications Div resumes meetings, Montreal
Nov. (Exact date unannounced) International Aero Exhibition Paris, France
Dec. 2-4 SAE National Air Transport Engineering Meeting Edgewater Beach Hotel Chicago.
Dec. 9-11 Annual meeting Society for Experimental Stress Analysis New Yorker Hotel, N Y C
Dec. 12-15 International Aviation Celebration El Paso Tex, auspices Chamber of Commerce
Dec. 17 IAS Wright Brothers Lecture N Y C
Jan 10-12 '47 All American Air Maneuvers Miami, Fla
Jan. 11-16 Aviation of Tomorrow Exhibit Miami Fla
Jan. 28-30 Fifteenth annual meeting IAS N. Y. C
Apr. 18-27 Michigan Aviation Week sponsored by Aero Club of Mich, Detroit
Apr '47 Western Air Show Los Angeles
May 9-17 Air Fair, sponsored by Aviation Council of Metropolitan St. Louis

Cosmic Ray Study Made

Survey of cosmic ray interference with radio and electrical equipment at high altitudes, covering 4,800 mi between the U S and Chile has been made by MIT AAF National Geographic Society and Bartol Research Foundation of Franklin Institute, Phila, jointly operating Boeing B-29 Superfortress

Investigated were mesons, energy units released when cosmic rays break up on contact with atmosphere Energy of mesons might implement cracking of atoms other than uranium as a source of power Dr W F G Swann reported electric instruments and radio seriously affected at high altitudes, and suggested modification of equipment might be necessary Little is known of cosmic rays except that they exist, approach the earth at various angles and can penetrate about 80 ft of lead

FLC Plane Sales Tallied

Foreign Liquidation Commission has sold 4,423 aircraft to overseas buyers in 2 yrs. ending June 30 More than half were DC-3 types Nearly all airlines in world now operate wholly or in part on U S surplus planes

FLC had listed 555 liaison planes abroad, but withdrew 200 in poor condition sold many at $300 each to armed forces personnel. Inventory shows 345 C-46s and 333 C-47s, most being early models Planes abroad are not sold to U S buyers nor can they be brought here

Telemetering Demonstrated

Navy recently demonstrated technique of telemetering (radio control and recordation of instruments in un-manned planes) at Marine Corps air station Cherry Point, N C Cornell Aeronautical Lab participated using Curtiss SB2C-5 dive bomber monitored by Grumman F6F "chaser" plane Bell Aircraft showed an F6F monitoring Grumman F7F Tigercat in rolls reversements and low runs. Telemetering is vital in critical testing of aircraft, in obtaining data from airfoils and shapes in free-fall tests, and in avigating un-manned bombers to de-

fended targets Officials told AVIATION'S representative at event that much could be learned by telemeter testing surplus planes to in-flight destruction

Cuts Affect AAF, Navy

President Truman's order reducing government agency expenses to meet 14% pay raise will hit personnel, research, and procurement in both AAF and Navy BuAer. Gen Spaatz announced 20% reduction in civilian personnel of AAF—from 162 000 to 131 000 Wright Field will be seriously affected as will its research program, including guided missiles Both Army and Navy expect that some procurement contracts will be cut back or canceled It is estimated the cut will set AAF and BuAer back about $2.25 billion. AAF will participate in fewer air shows.

Missile Program Unsettled

Efforts to resolve three-cornered tussle between AAF, Army Ordnance and Navy over guided missile research may or may not succeed. These services believe missiles will be vital in future combat and they want important part. AAF and Ordnance held meetings to iron out duplicate orders that had confused contractors. Maj Gen Aurand Army chief of research announced reconstruction of the Joint Guided Missiles Committee within framework of Joint Research and Development Board, set up by Secretaries of Army and Navy JGMC coordinated Army-Navy work during the war. It is proposed this one group take over guided missile program for AAF, Ordnance, and Navy, but jealousies may frustrate plan.

CAB Reveals Accident Score

Private flying fatalities increased from 258 in 1944 to 508 in 1945, probably due mainly to the vast increase in flying, over-age planes, and use of military surplus equipment not intended for such service CAB charged 3,361 mishaps—72.2% of all accidents—to pilot error Structural failures and fires caused 18.3% of accidents; miscellaneous, 9.5%.

Board Orders Fireproofing

New fire prevention equipment must be added to all present and forthcoming transport and executive planes of over 600 hp., according to CAB rules issued late last month.

Rules call for 1 Fire detectors and built-in extinguishers in all engine installations where combustible liquids are ignited Walls between engines and other parts of the craft must be fireproofed, 2 Flame-resistant materials must be used in passenger and crew quarters, there must be accessible fire extinguishers, and ash-trays must be improved, 3 Unless baggage and cargo are visible and accessible to crew, built-in extinguishers are required; and 4 Non-inflammable fluids must be used as soon as available

Necessary changes must be started by Jan 1.

BRITISH BOOST IT TO 616 MPH

Doing some very low buzzing in his record breaking Meteor IV is Group Capt E M Donaldson, commanding officer of RAF High Speed Flight and new holder of world's landplane speed record (616 mph), established over official course at Tangmere, England Craft differs from standard Meteor in that Derwent V turbojets deliver at least 4 000 lb. thrust instead of usual 3,600 guns are removed, a special dural cockpit canopy is fitted to obviate softening of Perspex panels at high speeds and a high waxed finish is applied (Air Ministry photo)

★ CANADIAN NOTES ★

By James Montagnes

First international Canadian air show, Toronto, under auspices of NAA of Canada displayed nearly a score of Canadian U S and British commercial aircraft, including DH Dove Fox Moth and Chipmunk, Fleet Canuck, Ercoupe Aeronca, Globe Swift, Luscombe Silvaire Bellanca Cruisair and Skyrocket Noorduyn Norseman, Piper Cub Stinson and mockup of new Canadian Fairchild Husky freighter Equipment manufacturers also had exhibits Rolls-Royce had new Nene jet engine Percival and A. V Roe (Canada) had exhibits but no aircraft Canadian and U S military aircraft including Seafires Mosquitos, and Shooting Stars, put on flight displays RCAF and Canadian Army paratroop section exhibited equipment.

Parliament voted $1,[illegible] for airport construction and for maintenance in fiscal 1946-47 Construction includes new airport at Saskatoon for Winnipeg, Edmonton service enlargement of Winnipeg airport airports on new Toronto-Winnipeg route via Sault Ste Marie and Ft William Reconstruction Minister Howe stated government airports on main routes across Canada do not pay their way, total take last fiscal year amounting to $198 848 TCA and Canadian Pacific Airlines pay $150 a month for first trip and $100 thereafter Personal planes pay $1 to $5 for landing at airports RCAF planes pay nothing

★ CALLING NAMES ★

W E Saye, Jr, has been appointed mgr. of Hawthorne Flying Service base at Rocky Mount, N. C.

Feeder Airlines Assn elections: James G Ray Southwest Airways, has been made pres Robert M Love, All American Aviation, v-p Gilbert R Cook West Coast Airlines secy, and Albert Zimmerly, Empire, treas

Colin H. McIntosh has been named to handle flight operations for Charles A Rheinstrom Aviation Consultant firm

UAL appointments **O. C. Enge** has been made asst. v.-p. passenger service at Chicago, **Karl Hughes** has been appointed district traffic and sales mgr at Washington

Walter W Barden has joined Northrop's engineering dept as service engineer

WAL elections **Marvin Landes** was elected v.-p. in charge of customer and station service, **Richard A Dick** was named v p in charge of traffic

W R Weiner has been named asst. chief pilot for Slick

John H. Geisse has resigned as asst. to administrator, personal flying development, of CAA, and will operate a nationwide rent-a-plane system

Aeronautical Training Soc elections **William R Kent** has been made pres **Maj C C Moseley** is v.-p. and **Wayne Weishaar** has been re-elected secy.-treas

Brig Gen William W. Welsh has been named technical adviser to Fairchild's gen. mgr.

Mark J Meidel has been named U S regional operations mgr for Scandinavian Airlines

Milton L Patterson has been appointed passenger traffic mgr for PAA's Latin American div and **Capt Wilbor W. Lynch** has been named communications director of same div,

Richard F Wehrlin has been elected pres of Aviec Instrument Co.

Solar Aircraft elections: **Edmund T Price** has been re-elected pres **Ray E Craig** has been named senior v-p **Herbert F Sturdy** and **C W Milligan** have been named v-p's **Jack L Oelman** has been appointed v-p and secy, **L M Kleuber** has been elected to board of directors

Joseph Ryle has been appointed AA's Eastern pub rel, dir

F W Wildman has been made director of budget for C&S

NWA appointments **A E Hayes** has been named regional traffic mgr for Alaska div and **Henry E McNaughton** has been appointed N Y district sales mgr

Elliott Roosevelt was elected pres of Empire Airlines and **Dean Alfange** was named chairman of board and general counsel

United Aircraft appointments: Following have been named divisional controllers **Richard T Horner** for Pratt & Whitney **Junius H Cooper**, for Hamilton Standard **James J Geffney**, for Chance Vought and **Frederick O Detweiler** for Sikorsky **Eric Martin** has been appointed acting mgr for Hamilton-Standard div, in addition to his present position of eng mgr

R. W. Hatch has been re-

1946 NATIONAL AIR RACES SCOREBOARD

Event	Place—Pilot	Plane	Engine	Time	Speed	Prize
Bendix RD Div	1 P Mantz	P-51	Packard R-R	4 42 14	435 501	$10 000
	2 J Cochrane	P-51	Packard R-R	4 52 004	420 925	5 000
	3. T Mayson	P-51	Packard R-R	5 01 056	408 98	3 000
Bendix J Div.	1 Col L Gray	P-80A	GE I-40	4 08 252	494 779	No Prize
	2 Maj G Ruddell	P-80A	GE I-40	4 18 512	474 836	Money
Weatherhead	1 Lt. W J Reilly	P-80A	GE I-40	12 450	578 36	No
	2 Capt J L Meutier	P-80A	GE I-40	12 570	572 792	Prize
	3 Capt D E Eberhardt	P-80A	GE I-40	12 636	569 801	Money
Sohio	1 D Fulton	P-51	Packard R-R	40 46 11	352 781	$8 000
	2 W Ong	P-51	Packard R-R	41 38 07	345 867	3 500
	3 J Hardwick	P-38	Allison (2)	44 38 03	322 625	2 000
Halle	1 M Hurlbert	AT-6	P&W Wasp	23 26 04	200 588	$2 500
	2 J Page	AT-6	P&W Wasp	22 26 89	200 462	1 000
	3 R Johnson	AT-6	P&W Wasp	22 56	196 221	750
Thompson R Div.	1 A Johnston	P-39	Allison	48 8 41	373 908	$19 000
	2 A LeVier	P-38	Allison (2)	48 37 4	370 193	8 000
	3 E Ortman	P-51	Packard R-R	48 57 77	367 625	4,500
Thompson J Div.	1 Maj G Lundquist	P-80A	GE I-40	20 56	515 853	$25 000 to
	2 Maj R Olds	P-80A	GE I-40	20 58	514 715	Army-Navy
	3 Capt. A M Fell	P-80A	GE I-40	21 12	509 382	Relief

JACK WOOLAMS

Hard blow to aviation was death of Jack Woolams, chief test pilot of Bell Aircraft, who was about to make initial attempt at supersonic speed in the XS-1. Woolams was killed several days before Thompson Trophy Race while flying a souped-up P-39 racer which broke up in mid-air and crashed into Lake Ontario. He revealed pioneer efforts to pierce sonic barrier in special article "How We are Preparing to Reach Supersonic Speeds", page 38, Sept AVIATION. Tests with XS-1 are to continue. At Bell, Alvin "Tex" Johnston (see Aviation People page 115) succeeds Woolams as chief test pilot. (INP photo)

assigned as chief meteorologist for Mid-Continent Airlines at Kansas City.

Juan Trippe, PAA's pres., has been elected to board of directors of Commerce & Industry Assn., N. Y. C.

TWA appointments: **W. G. Golien** has been named asst gen mgr technical of International div., and **M. E. Sheehan** has been made asst. gen mgr administrative.

Paul E. Reinhold has been elected to board of directors of EAL. Other company changes:

James L. Grafton has been made station mgr at Providence. **Allan M. Dexter** has been appointed city mgr at Providence. **Lanier J. Bishop** has been named district mgr in Carolina.

Maj. Gen. Laurence S. Kuter has been appointed U. S. representative to PICAO at Montreal.

W. B. Tischendorf has resigned as director of sales, adv., and pub. rel. for Laister-Kauffman.

James G. Kiper, recently with N. W. Ayer on Bell account, has joined James W. Irwin & Associates as a group exec.

★ SPOT CHECKING ★

Successful shipment of delicate radio precision equipment via Douglas-built Flying Tiger plane was claimed as first such air freight achievement after completion of recent flight from Los Angeles to Teterboro, N. J., airport.

In recent National Soaring Contest, 13th such annual event, gliders flew total distance of 6,000 mi. in 185 contest flights representing 315 air-hours.

Four Goodyear Pliocel tanks and 52 bladder wing cells were installed on Boeing B-29 Pacusan Dreamboat to boost fuel load 3,000 lb. for Oahu-Cairo non-stop run over North Pole.

International League of Aeronauts has been established, with hq in Paris, to initiate action for resuming Gordon Bennett International Balloon Race and generally promote revival of sport. League's U. S. representative is J. Gordon Vaeth, Buckingham Place, Scarsdale, N. Y.

Air Commodore Frank Whittle RAF has been awarded Daniel Guggenheim Medal for Achievement in Aeronautics for pioneering development of turbo-jet propulsion of aircraft.

Recent CAA tally reveals that July was all-time monthly high for student pilot certifications with a total of 21,935.

First human in U. S. to be shot out of plane in new high-speed bail-out apparatus was 1st Sgt. L. Lambert, who in recent Air Materiel Command test for developing supersonic craft equipment was catapulted from Northrop P-61, separated from ejection-seat in mid-air, then chuted safely to ground.

Publications: "Origin, Distribution, and Airphoto Identification of U. S. Soils, with Special Reference to Airport and Highway Engineering" is comprehensive illustrated handbook in relation to airport construction and use of air photos in selecting field sites. Preparation was by CAA and Purdue U., and issuer is Supt. of Documents, Government Printing Office, Wash., D. C. Price is $2.00. . . . "A World of Neighbors", illustrated color pamphlet issued by PAA, is travel preview describing peoples and customs of Europe, Africa, Latin America, Asia, Pacific area, Canada, and U. S. . . . "Industrial Planning—A Safeguard of Peace" is booklet issued by Fairchild Engine & Airplane Corp. setting forth speech of company Pres. J. Carlton Ward Jr. before ASME. Topics include relation of industry mobilization to war plans, prewar production, foreign orders, craft development time, supply of engineers and civilian management.

NAVY TESTS ELECTRIC CATAPULT

Navy mechanics ready a Lockheed P-80A for takeoff via Westinghouse's newly developed Electropult launcher, which is essentially a huge electric motor laid out flat. Track (1,382 ft. long) corresponds to a conventional machine's rotor, while small shuttle car acts as stator. During recent demonstrations, P-80A was launched at 216 mph. in 4.1 sec after a run of only 340 ft. It's stated that designs have been completed for Electropult capable of launching big airliners at 120 mph, with 500-ft. takeoff run. See article, page 62. (Press Assn. photo)

THE WASHINGTON WINDSOCK

By BLAINE STUBBLEFIELD

Experts have made speeches for ten years about an impending shortage of airports. Now it's here, the main impediment facing transport and personal aviation. Seems they didn't talk fast enough.

It was worthy news, in Aug. 1928, when airmail was reduced to 5¢ the other time. This time it's broader news because it's practically the only item that's come down in cost—and the Government did it!

There were jet engines two-three thousand years before somebody decided to make them work. Researchers are investigating jet for propulsion of water craft. If it works, our neo-whoosh men will feel as silly for not doing it earlier as they did for not beating Whittle.

Scheduled airlines utilize only 25% of total use of airports on their system, an ATA survey shows—not 44.8%, as CAA reports indicate. Reason for the "discrepancy": Scheduled carriers file flight plans for all trips, while other flyers usually file them only in instrument weather. ATA says 57% of utilization is by other commercial and 18% by military aviation. ATA V.-P. Robert Ramspeck wants those facts remembered when there's talk about how much airport cost the airlines shall be responsible for.

Army and Navy always try to outdo each other in new developments—especially in news headlines. Reporters call up Army and say: "Navy is doing so and so. What about you?" Then Army does more of the same. And vice versa. It's expensive—but it's good reading.

Stuart Symington, Assistant Secretary of War for Air, is one of the hardest-working men in Washington. A lot of people who didn't like his appointment are changing their minds.

Rube Goldberg has nothing as good as the Air Materiel Command's pilot ejection seat. You pull a lever and get thrown 40 ft. straight up. Then you wait 3 sec. for an explosion, which separates you from the seat. Finally, you wait 3 sec. more for another explosion to open the chute. Who? You.

Administration turned the heat on aircraft manufacturers to build prefabricated aluminum houses. Most didn't want to, even with FHA's 90% guarantee against loss. Production lines can build houses cheaper than the construction industry can, now or any time. If public goes for prefabs and it becomes big business, those who stayed out will rue the day.

If CAB refuses to regard steamship companies as eligible for certification to operate air services despite Sea-Air Committee's petition, then the Committee will try to drive through the 80th Congress a bill authorizing the Maritime Commission to certificate them. And railroads, not now active, may join the push.

U. S. Industry Preparedness Problem Looms; Billion-Dollar Output Seen for This Year

. . . Exports near prewar mark . . . Aircraft makers plan prefab home units . . . Military deliveries down.

International relations are uneasy and Washington is mulling industrial preparedness plans that are certain to collide with Administration's economy drive

If the Government is to stand ready on short notice for emergency, it must maintain research facilities and production know-how

Present research programs, if not too much cut for lack of appropriations plus those to be set up and those expected to be authorized by Congress, are considered adequate

Year ago Air Coordinating Committee recommended ten airframe and four engine plants be held in standby Donald Nelson, former WPB chief has been called by President to confer on surplus plants Army-Navy Munitions Board working quietly on industrial preparedness may revise vital standby plant program, including aviation.

Most serious and costly is continuous know-how Blueprint system set up before war was complete failure To know how to make things manufacturers must be making them That means some sort of educational orders for all new designs Ideal setup would be limited production of every military need by all needed manufacturers. No cheaper method of doing it is in view at this time

Billion-Dollar Output Seen for This Year

Aircraft Industry's hope that it would do billion dollar annual business in peacetime probably will be realized this year About half constitutes military orders, about one-fourth represents 35 000 civilian aircraft, and other fourth covers engines propellers instruments, and parts. Military business is bread and butter but uncertain. Research contracts are large part of military work, and these could be cut for economy, also to stop duplication as in missiles field Industry has working capital of about $812,000,000. This year's billion dollar volume is triple that of '39

Exports Near Prewar Mark

Year after VJ-Day, the industry had delivered 17 400 planes Exports of aviation equipment may exceed $100,000,000 in 1946, or nearly that of 1939 figure despite Government's ban on shipment of military planes, which prewar, was sizeable portion of total production. Exports for first six months are 842 units value $55 000,000 But this includes surplus sold by Foreign Liquidation Commission out of domestic stocks.

British and U S governments have moved to jointly ban shipments of warplanes The prewar export was 30% of total aircraft production France, Canada and Britain Sweden Brazil, Netherlands Mexico, Australia, Belgium and South Africa are leading U S customers.

Aircraft Makers Plan Prefab Home Units

At this writing, two to six aircraft manufacturers are expected soon to begin production of aluminum prefabricated houses, with FHA guaranteeing 90% of the cost through purchase by RFC of any units not sold WAA withheld 50 aircraft and their type plants for sale or lease for house production Douglas held long conferences with FHA and so did McDonnell which has own design One company reportedly signed up for 10 000 units Two-bedroom aluminum prefab weighs ton is quoted at around $3,000 All sizes are made of panels 4 by 8 ft both sides aluminum sandwiching other material for stress and insulation, 2 in thick for walls, 3 in for ceiling-roof Main problem for aircraft companies is distribution

Military Deliveries Down

Military aircraft acceptances declined to 67 in July AAF taking 13 and Navy 54 To AAF 1 Lockheed F-80A, 8 Lockheed FP-80As, 1 Douglas C-74, and 3 Fairchild C-82s. To Navy 2 Martin PBM-5Es, 1 Lockheed XP2V-1, 21 Vought F4U-4Bs 21 Grumman F8F-1s and 9 Grumman F8F-1Bs Total airframe weight was 516,100 lb., compared with 715,400 lb in June

Important Committees Changed

Under recently passed Congressional reorganization bill merging military and naval affairs committee in both House and Senate to a single Committee on Armed Services in each house, Rep Carl Vinson (D, Ga) and Sen David Walsh (D, Mass) will become top military aviation leaders on Capitol Hill Walsh is facing a stiff election race this Fall Both of these men are strongly pro-Navy Only a Republican majority in Congress would turn status Such a change would put Rep Walter Andrews (R N Y) in as chairman of the House Armed Services Committee and Sen Styles Bridges (R N H) in the Senate committee Both are AAF champions

★ FOR THE RECORD ★

B. F. Goodrich leased government building in Troy Ohio to house its aircraft wheel and brake division Also company acquired Hayes airplane wheel and brake division will be transferred to Troy

Southwest Airmotive and Dallas Aircraft Sales are now associated at Love Field Dallas municipal airport Southwest is Beechcraft maintenance and overhaul organization while Dallas Aircraft is Beech distributor for northern half of Tex and La

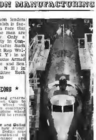
Hawthorne Flying Service is scheduling construction work for mid-October on its new airport base at Craig Field Jacksonville Fla

New companies Airborne Commodities Sales Refiners Bldg, Dayton, Ohio established by H K Crowl to develop markets for airborne fruits vegetables flowers seafood and other commodities . . . Charles A Rheinstrom, aviation consultant 31 Fifth Ave, NYC His former association was v-p, traffic and sales and director of AA . . . Rockel Aircraft Corp, Ft Worth for manufacture and distribution of Rockel 18s Company purchased controlling interest in Johnson Aircraft . . . Fleishman Hillard & Associates 3007 Olive St St Louis publicity counselor firm one specialty being study of public relations problems in mass transportation systems Company is affiliated with Krupnick & Associates advertising agency of that city . . . Physioc & Merckle public relations firm at 366 Madison Ave NYC Formerly associated with Republic J A Physioc was in personal plane division H Merckle was in charge of press relations.

Change of names Allied Control Co of Cal, 1633 S. Hope St Los Angeles to Pierson Electrical & Engineering Corp . . . Hoosier Air Freight Corp to Aire Borne Cargo Lines

Luttrell & Senior, air transport engineering firm has moved from 41 E 41 St to 331 Madison Ave, NYC but drafting dept. remains at old location

New accounts: Beech Aircraft advertising to Ruthrauff & Ryan . . . Scandinavian Airlines group advertising—including Danish DDL, Norwegian DNL and Swedish International SILA—to John A. Cairns & Co with Leo Baron as account executive . . . Atlantic Airlines to Airways Engineering Consultants of Washington for consultation on all matters of airways and airport planning . . . Irving Air Chute Co advertising to Addison Vars Co of Buffalo which will also handle publicity and sales promotion and act as counsel on marketing and merchandising



FIRST 202 TAKES FORM

First photo of fuselage of prototype Martin airliner, which is scheduled to make its initial flight this month Width is emphasized, indicating interior roominess Deliveries of high speed 36-40 passenger craft are to start early next year with orders to date from six U S. and two South American operators.

★ INDUSTRY MEMOS ★

Taylorcraft has been cut from [illegible] to [illegible] in F.A.F prices of custom standard and deluxe BC12Ds . . . Company went into production of new Ace two-seater selling at $1,995 F.A.F

Aviation Maintenance Corp Van Nuys has been awarded $2,700,000 contract by Air Materiel Command to maintain and service ATC's Pacific planes.

Ryan announced helicopter development program . . . Company installed test cell for testing large jet engines and allied equipment

Boeing received orders from BOAC for six Stratocruisers for delivery in latter part of '47 License agreement was arranged for Chinese Republic to manufacture Boeing PT-17 Kaydet trainers.

Lockheed received orders from All American Aviation for five Saturns, costing about $125,000 each

Intava announced AAF contract for into-plane fuel delivery service in 43 countries with cost stated at over $5,000,000

Piper completed 5,000th Cub since VJ Day and reports backlog of over [illegible] Super Cruisers and 6,000 Cub Specials.

Piasecki Helicopter Corp broke ground on its future $500,000 engineering and manufacturing plant at Springfield Pa New site capable of further expansion is to be operating in early '47.

Lightweight VHF for Aircraft

The 17K-1 is a five frequency, crystal controlled radio transmitter for commercial and itinerant aircraft use in the 122-132 mc band The complete transmitter, including a dynamotor power supply, is housed in a single ½ ATR unit cabinet. Transmitter, control box, and interconnecting cable weigh less than 20 pounds

Remote control facilities allow complete freedom in locating the 17K-1 in the plane An antenna transfer relay is available, if desired, in order to operate a receiver from the transmitting antenna

The power output, adequate for the VHF range, is conservatively rated at 5 watts Total power drain is held to a minimum during both stand-by and operation

The audio circuit employs peak clipping to raise appreciably the effective modulation level and allow full use of the carrier power

The 17K-1, thoroughly engineered and flight tested, enables its owners to obtain maximum benefit from the new VHF aircraft frequencies Write today for early delivery.

SPECIFICATIONS:

Frequency range 122 132 mc
Size ½ ATR unit
Total weight less than 20 pounds
Number of frequencies five.
Frequency control quartz crystals.
Power output 5 watts minimum.
Type of emission voice modulation.
Output impedance 50 ohm concentric line.
Power source 12 volts d-c or 26 5 volts d-c

IN RADIO COMMUNICATIONS, IT'S . . . COLLINS

COLLINS RADIO COMPANY, Cedar Rapids, Iowa

11 West 42nd Street, New York 18, N. Y. 458 South Spring Street, Los Angeles 13, California

State Dept. Negotiates Bilateral Pacts To Frame U.S. Flag World Air Pattern

. . . PAA-Panagra plan opposed . . . Sea-Air body seeks review . . . POA asks CAB certificate . . . Connies winging again . . . N-S data filed.

Steady progress in slow task of building U S flag world air system continues despite shortages and political obstructions.

Since CAB completed all regional cases set up in U. S world air pattern projected in '44 State Dept is taking over, and has obtained operating rights in 19 countries for U S. carriers, and under bilateral agreements, unsuccessfully opposed in Congress, has authorized 16 foreign nations to enter here, tapping U S air commerce estimated at 80% of world total.

Twelve countries have been awarded points of entry in heavy U S traffic zones: Britain, Canada, France, Denmark, Ireland, Norway, Sweden, Czechoslovakia, Portugal, Belgium, Switzerland, and Netherlands. Six others have not yet been awarded gateways here because they are not ready to operate.

Before operations under CAB awards can begin, State Dept must complete negotiations with 25 foreign countries. Efforts to reach agreements with Russia, the Balkans, Mexico, and India have not succeeded so far.

Three U S flag carriers PAA, TWA, and NWA have been awarded world-spanning routes in Pacific. PAA becomes round-the-world operator with extensions on South Pacific and Southeast Asia. TWA got extension from Bombay to Shanghai. NWA received 7-yr certificate to operate from New York and Chicago to Manila via Alaska and Tokyo. TWA and NWA will cooperate in combination world circuit.

In South Atlantic, last of international route cases, CAB awarded to PAA two routes terminating at Johannesburg and Capetown—one from New York via Azores, Dakar, and Leopoldville other from Natal via Ascension Island. These routes awarded to capture South African trade for U. S. may cost government around $2.5 million yearly in mail subsidies.

U S has withdrawn from its own proposed fifth freedom of air convention which would have permitted airline of one country to pick up traffic in second for third country. Hence world air system will be built on basis of bilateral negotiations — which means horse trading with no tricks barred.

PAA-Panagra Plan Opposed

Contract agreement which, if approved by CAB, would permit PAA to charter Panagra planes non-stop over PAA's routes between Canal Zone and U. S., is opposed by EAL, C&S, NAL, and Braniff, also by Justice Dept. This agreement, to run for 99 yr follows long conflict between PAA and Panagra and an unsuccessful effort by latter for certification into U S. EAL Pres. E V Rickenbacker said companies were trying to establish front to reinforce their U. S. flag "monopoly" in Latin American areas.

Sea-Air Body Seeks Review

Sea-Air Committee acting for nine steamship lines has petitioned CAB to review effect of exclusion of surface carriers from air. Committee wants CAB to state position of sea applicants, and to find that they are not under any restrictions not imposed on other applicants. CAB is asked to study effect of admitting steamship-dominated foreign airlines into U S while excluding home maritime interests. Committee also has bill before Congress authorizing Maritime Commission to certificate shippers to operate air services, which would then function under civil air law.

POA Asks CAB Certificate

Pacific Overseas Airlines, Ontario, Cal, has asked CAB for permanent certificate between Los Angeles and Hawaii on scheduled basis. POA does not contest recent award to UAL of route from San Francisco to Hawaii. CAB, because its vote was divided, reopened case to reconsider whether additional service is necessary from Los Angeles. POA Pres J. E. Jones claims extensive C-54 experience with ATA and says three such craft are available. Fare would be 5¢ per mile

Connies Winging Again

Grounding of Constellations was almost forgotten as operators put back planes with conformation to CAA requirements. PAA placed first modified plane in service on Atlantic, planning to use 13 of Model 49-51s, with carburetor engines BOAC also started service with this type TWA completed first 100-hr. test of 49-46 with fuel injection TWA's fleet will be 30 Model 49s and 18 Model 649s with berths. AOA expected first of fleet of 12 Model 49-46s back in service this month. KLM and Air France were reported installing fuel injection

N-S Data Filed

Request of the Commerce Dept.—that the CAB restore original exemption order and set aside restrictive interpretation and definition of "non-scheduled," also that it reopen Dockets 1501 to permit further testimony by non-scheduled carriers—has no legal standing, because CAB is not responsible to Commerce But the appeal carries considerable weight.

By Sept 3 deadline for comment on proposed changes in Economic Regulation 292.1, more than 300 operators had registered with CAB Less than half of those registering claimed planes of transport size—Lodestars, or larger Registration was to give CAA traffic and financial data on non-scheduled system. Operators were to have applied for operating certificates by Sept 15 There was no deadline on application for certificates of convenience and necessity.

★ CROSS COUNTRY ★

TWA is completing $40,000 food preparation plant for San Francisco Municipal Airport. New unit will afford a 3,000-meals monthly capacity.

San Francisco Municipal Airport reports new traffic highs with 15,203 planes in and out covering fully 367,454 passengers during first six months of 46, an increase of 71.1% and of 88.6% respectively, over same period last year.

Transocean Airlines, Oakland subcontractor for UAL in ATC operations between Calif and Hawaii, started weekly flights to Manila using Douglas C-54s under contract with Philippine Air Lines. Orvis Nelson, TAL pres., says company now has three planes.

Nonscheduled and contract carriers are said to be flying over 4,000,000 ton-miles of freight monthly, five to ten times as much as scheduled airlines.

IATA joined PICAO, CAB and ATA, and other groups in an effort to reduce time spent on air travel visas passports, and other inter-country red tape. Fifty nations have their own forms and procedures. It is stated that paper work frequently takes more time than trip.

AIRBORNE COOLER

New type refrigeration unit for flying freighters is seen here being checked in a Santa Fe Skyways DC 3 by Douglas engineer Ed Wilkes Designed and built by aircraft maker, unit weighs but 300 lb. and is said to maintain cabin temperatures of 70-32 deg F Dry ice is placed in alcohol in a tank at bottom of unit, cooling alcohol to —120 deg F, and alcohol is then sent through cells at top by means of electrically driven pump. A blower behind cells circulates cool air through cabin.

CANADA'S NEW FAIRCHILD HUSKY

Seen aloft during flight tests all-metal Canadian bush freighter displays unusual fuselage shape Strictly utilitarian craft is powered by a 450-hp. P&W Wasp weighs 6,400 lb loaded, and is said to have 138-mph top speed Total cabin volume is given as about 240 cu ft, with loading facilitated by extra-large doors on each side of fuselage and with a third door underneath, just behind rear windows. Wing loading is stated to be but 17.75 lb./sq ft. Eight to eleven passengers may be carried Husky is tentatively priced at $39,000 including floats and all equipment but radio Production is already underway. (James Montagnes photo)

BRITISH EXPORT NEW J-P FIGHTERS

Five new DH Vampire jet-propelled fighters are seen just prior to en masse flight to Sweden for use by that country's air force Latest modifications, such as bubble canopy and long-range wing tanks, are in evidence This craft is also being produced for Switzerland and France ("The Aeroplane" photo)

WORLDATA . . . . By "VISTA"

During debate on Britain's airlines nationalization bill, the Ministry for Civil Aviation solemnly announced that once production of new civilian planes is in high gear, no more American planes would be purchased It was stated at that time that the new Avro Tudor I would soon be in a position to take over on the Atlantic routes, to be followed shortly by the Tudor II By 1948 the first giant 167 Bristol 285 000-lb transport would be in service and in 1950 the Brabazon IV, a jet-engined flying wing built by de Havilland, would cross the ocean at 550 mph.

Such optimistic reports from the Ministry aided speedy passage of the nationalization bill through Commons and the British Press renewed criticism of the Lockheed Constellations, which in the meantime had been grounded around the world. As an anti-climax, late August brought an official announcement that the Tudor I was totally unsuitable for the Atlantic routes and that service with these aircraft could only be maintained at a cost of a £1 000 000 subsidy per year As for Tudor II and the Hermes their total fuel capacity is under 3 000 gal., which leaves little margin for Atlantic crossings In addition both these types have run into serious prototype troubles

The Bristol 167, now under construction is supposed to fly early in '47 But experts feel it won't take the air until late '47 and that it'll be 1948 before the novel engine installation and nosewheel door pressurization are sufficiently tested The new de Havilland flying wing cannot be expected to enter commercial service before 1950 or 1951

At any rate, factors haven't looked too good, so there finally came from the Ministries a tailend announcement revealing purchase of six Boeing Stratocruisers "to maintain fully competitive service on the New York route in 1948-1950, till new British trans-Atlantic airliners are ready".

Pressure in France to again attain a prominent air position has been severely tempered by a series of accidents Following the debacle of the six-engined Latecoere flying boats in the South Atlantic service, a number of new aircraft were sent to South America to recoup France's position, but after fatal and near fatal accidents, the mission was ordered to return to France At the same time Air France announced that it was again operating all its prewar routes and that further speed-up of services would follow A few days later, Air France lost two DC-3s in Europe, killing 42 persons, and it also suffered a number of minor mishaps.

★ INTERNATIONAL BRIEFS ★

ENGLAND—$80 000 000 will be expended for creation of aerodynamic research laboratory at Thurleigh near Bedford Installation will include supersonic windtunnels and is patterned along NACA lines

Vickers Jet E 10/44, a new gas turbine-powered fightercraft recently made successful first flight Similar to the Republic P-84 Thunderjet, plane has new Rolls-Royce Nene

FRANCE—One of largest exhibits at coming air show is to be that of British Aircraft Industry, whose theme is expected to be new speed record, expected to push point r past 1,000 km /hr. (622 mph)

NORWAY—Operation of new Norway-Denmark-Sweden airline combination known as Scandinavian Airlines System, started in September using Douglas DC-4s. Per Norlin of Swedish SILA, well-known in U. S., is director.

RUSSIA—Recent airshow included demonstrations of turbo-jet and resonance jet-powered fighters reported to have high speed and maneuverability. Designs followed German principles and are said to have been developed by German engineers.

INDIA—Tata Airlines being reorganized as Air-India, Ltd started operations between Bombay and Calcutta Deccan Airways operates Madras-Delhi route in cooperation with Indian National Airways while Bharat Airways Ltd connects Calcutta and Bombay with New Delhi

AUSTRALIA—Construction is under way on concrete runways for Melbourne's airport which will be from 1,400 to 6,100 ft long, suitable for aircraft up to 100 000 lb Plan is expected to cope with air traffic for next 10 yr.

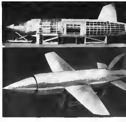
Inadequacy of the Lancastrian service to England was demonstrated by recent flight which carried 2,400 lb of mail leaving room for only two passengers Maximum passenger capacity for the five-stage trip is five passengers.

BRAZIL—Paulista company developed a 4-1 place lightplane powered with Continental engine Reported to have spin and stall characteristics similar to Ercoupe, plane is designed to sell for less than $5,000

MEXICO—Aerovias Reforma, airline owned by Alberto Leal received permanent franchises for routes from Mexico City to Ensenada via Guadalajara Culiacan and Guaymas from Mexico to Acapulco via Puebla and from Mexico to Houston via Puebla Tampico, and Brownsville Three L-4s are now being converted for passenger service

BERMUDA—Bermuda Assembly granted Canada and TCA four-year monopoly on air service between Montreal and Hamilton TCA plans to start operations this Fall with extensions to Jamaica, Bahamas and Trinidad

COLUMBIA—Ministry of War which controls civil aviation here, is planning 5% tax on all air transport sold in this country Money would go to nationalize all Columbian airfields



UNVEIL MILES SUPERSONIC PROJECT

These mockup views of Miles M 52 reveal British progress in designing planes for faster than-sound human flight. Craft was planned for top speed of 1 000 mph at 36,000 ft, which height was to be attained only $1\frac{1}{2}$ min after takeoff Length is given as 33 ft and wingspan 27 ft. A specially designed Power Jets unit would deliver equivalent of 17 000 hp However further work was halted when Air Ministry dropped project for economy reasons (Press Assn photo)

E. F. PIERCE has been named mgr. of special propulsion division Wright Aero's engineering dept., in which post he will direct company's development program in field of new types of power plants. He studied aeronautical engineering at Worcester Polytechnic and holds a degree in mechanical engineering.

DR. JEROME C. HUNSAKER, editorial consultant of "Aviation" and director in McGraw-Hill Publishing Co., has been elected a director of Goodyear Tire & Rubber. He is head of dept. of aeronautical engineering at MIT and chairman of NACA and an honorary fellow of IAS and Royal Aero. Society.

COMDR. EDWARD M. OWEN has become chief experimental test pilot for Chance Vought div., United Aircraft. He recently was awarded gold star in lieu of his third distinguished flying cross and is a veteran naval flight test and combat pilot. He was commanding officer of a fighting squadron on "Yorktown."

CAPT. WILLIS E. CLEAVES has been appointed mgr. of aviation sales dept. of Collins Radio. He recently retired from Navy after 22 yr. service. An Annapolis graduate, he specialized in aviation communications graduate work there and at Harvard. At time of retirement, he was comdr. of aircraft carrier "Pelian."

COL. STEWART W. TOWLE JR., has been named Northrop's Wash. representative, following his retirement from Army after 13 yr. service. Formerly chief of staff of 8th Fighter Command in England, he was decorated by U. S. and Britain for setting up fighter operations in England during early part of war.

GERMANICO VANDO has been appointed traffic representative for EAL's new air service route at San Juan, Puerto Rico. A San Juan business executive, he was formerly associated with Office of Distribution, U. S. Dept. of Agriculture. EAL launched its service from Miami Gateway to Puerto Rico last month.

JOSEPH D. MOUNTAIN has been appointed director of TWA's all-weather flying program. During war he was col. in AAF and worked with ATC and bombing units in maintaining reliable flight operations during monsoon season. In '45 he became exec. officer of committee for air navigation and traffic control.

RICHARD T. McINTOSH has been elected pres. of Airlines Club of N. Y. At present associated with PAA he has been in aviation field for number of years and he is a private flyer. Earlier, he was connected with NWA and EAL. He is one of original founders of club and has given much time to its affairs.

PROF. GARVIN L. VON ESCHEN has been appointed chairman of Ohio State University's dept. of aeronautical engineering. He has taught civilian and military aeronautical engineering courses, and has served as supervisor of a wind tunnel design and construction project. He is a private pilot.

A. WILEY SHERWOOD has been appointed prof. of aerodynamics in Glenn L. Martin School of Eng. & Aero. Sciences, at U. of Md., where he will manage new wind tunnel project. Previously he was aeronautical project engineer at David Taylor Model Basin. He is author of textbook "Aerodynamics".

SIDNEY A. STEWART has been elected exec. v.-p. at C&S. Previously, he was v.-p. and gen. mgr. of Hamilton Standard Propellers div. of United Aircraft. A graduate of Princeton, he has had a private pilot's license since '33, and was a naval aviator in World War I. (Bachrach photo)

WALKER PERCY, secy. gen. of Caribbean Regional Air Navigation Meeting of PICAO, has been awarded Legion of Merit for his services as war dept. liaison officer with organization. A major in AAF during war, he joined CAA in May as coordinator of activities relating to PICAO.

ALVIN M. "TEX" JOHNSTON has been named chief airplane test pilot for Bell Aircraft. Winner of recent Thompson Trophy Race, he learned to fly at Spartan School of Aeronautics. He holds a commercial license, CAA instructor's rating, and U. S. Army primary and basic instructor's rating.

D. J. KING (left) has been appointed gen. mgr. of Northwest Airlines' Orient region, in which post he will handle negotiations with China, Philippines, and Allied Command in Tokyo for landing rights and facilities. A pilot for 20 yr., he has flown throughout North and South America. (George Miles photo). **EDWARD A. STERN** (right) has been named head of NWA's public relations with hq. in N. Y. Formerly with PAA, he has been associated with aviation for number of years. He recently completed tour of Northwest Airlines' coast-to-coast system. (Don Barg photo.)

KEEP POSTED ON
Products and Practices

INFORMATION TIPS

ENGINEERING DATA

Alloy Data 1
Containing engineering information on strength, electrical resistivity, modulus of elasticity, heat treatment, temperature limits, and magnetic properties of alloy wire, rod and strip, Catalog No. D-[illegible] issued by **Alloy Metal Wire Co.**, Prospect Park, Pa., also gives tables of sizes and weights.—AVIATION, Oct., 46

Lock Nut Tests 2
Test Procedure, is new booklet published by **Elastic Stop Nut Corp. of America**, Union, N. J. Described is procedure for testing locking effectiveness of self-locking nuts and related devices.—AVIATION, Oct., 46.

Technical Bibliographies 3
Including lists of sources of information on photo templates, photolofting, photodials, ennameplates, and photogrid printing for stress analysis, a bibliography on photoreproduction is available from **Eastman Kodak Co.**, Rochester, N. Y. Also available is bibliography on spectrography covering chemical, flash, infra-red, and mass spectrography.—AVIATION, Oct., '46

Material Testing Charts 4
Brochure from **W. C. Dillon & Co.**, Chicago, contains charts compiled to give time saving help in calculation of material testing, showing factoring of specimen tests for materials. Also described are instruments and equipment used.—AVIATION, Oct., '46

X-Ray Spectrometer 5
Explaining history and construction details, Booklet No. [illegible] issued by **North American Philips Co.**, N. Y. C., on Geiger-Mueller X-ray spectrometer, gives circuits and data pertinent to correct usage.—AVIATION, Oct., 46

PRODUCTION

Gage Catalog 6
Including data on salvage of wartime surplus gages, and details of new centerless lapping machine, Catalog No. 846 issued by **Size Control Co.**, Chicago, describes null and components of size control reversible plug and thread gages, snap gages, ring gages, twin plug gages, and measuring wires.—AVIATION, Oct., '46

Surface Reading Recorder 7
Designed for use with company's profilometer, new reading recorder, producing a continuous chart record of average roughness of surface being measured, is described in leaflet from **Physicists Research Co.**, Ann Arbor, Mich.—AVIATION, Oct., 46

Ball Bushings 8
Booklet published by **Thomson Industries**, Long Island City, N. Y., explains operating principle and features of new ball bushings for linear motions, giving standard dimensions, installation data and load ratings on sizes from ¼ to 4 in. shaft dia. (Also see illustrated item, page 79 of our Sept. issue.)—AVIATION, Oct., '46.

Optical Projection Comparators 9
Folder from **Engineers Specialties Div., Universal Engraving & Colorplate Co.**, Buffalo, N. Y., describes process and features of gaging with optical projection comparators.—AVIATION, Oct., 46

Precision Casting 10
Bulletin No. 19B[illegible] issued by **Allis Chalmers Mfg. Co.**, Milwaukee, discusses advantages of precision casting in handling materials difficult to machine or forge by using either lost wax or plaster molding process.—AVIATION, Oct., 46

Metering Tube 11
Fischer & Porter, Hatboro, Pa., has issued Catalog Section [illegible]-A describing new bead-guide metering tube for use with Rotameter type flow rate metering instrument.—AVIATION, Oct., '46

Special Purpose Machinery 12
Dynamometers for testing prime movers for hhp, torque, efficiency, load and fuel; static balancing machines for balancing revolving parts; and bench and floor drills for drilling holes from .001 in. to ⅜ in. are described in three bulletins published by **Taylor Mfg. Co.**, Milwaukee.—AVIATION, Oct., '46

Backstands 13
"Production Talks Backstands," is new booklet issued by **Behr-Manning Corp.**, Troy, N. Y., to show and describe use of backstands in grinding and finishing production.—AVIATION, Oct., 46

MACHINERY AND ACCESSORIES

Tachometer 14
Ideal Industries, Sycamore, Ill., has issued leaflet describing panel type tachometer designed to be installed on machines and to provide a meter mounted on control panel in view of operator.—AVIATION, Oct., '46

Altitude Units 15
Containing specifications and technical data chart, new folder from **Bowser, Inc.**, Terryville, Conn., describes laboratory and production testing unit developed to simulate varied altitude conditions.—AVIATION, Oct., 46

Clamps 16
Blueprint drawings, construction details and specifications of line of standard clamps are covered in catalog from **Marman Products Co.**, Inglewood, Cal. Also covered are special clamps including straps, channel band couplings, V-band couplings and manifold couplings.—AVIATION, Oct., '46

Presses 17
Bulletin No. [illegible] C from **Watson-Stillman Co.**, Roselle, N. J., describes construction and work features of general purpose presses of 20 to 250 ton capacities designed for metal working and plastic molding.—AVIATION, Oct., '46

ELECTRICAL

Metals and Alloys 18
Including lists of physical and electrical characteristics, Bulletin No. B-3369 has been published by **Westinghouse Electric Corp.**, Pittsburgh, for engineers and designers of communications and electronic equipment as a guide to properties and applications of recent metallurgical developments.—AVIATION, Oct., '46

Vacuum Capacitors 19
Designed for use in aircraft radio electronic circuits, vacuum capacitors are described in Brochure ETX-2 issued by **General Electric Co.**, Syracuse, N. Y., which also contains schematic drawings, circuit diagrams, rating and installation information.—AVIATION, Oct., 46

Photoelectric Control 20
Bulletin No. 31[illegible]-P from **Photoswitch**, Cambridge, Mass., contains descriptions and specifications of new industrial photoelectric control unit.—AVIATION, Oct., 46

Insulators 21
Including information on design criteria, specifications and technical data, Catalog No. [illegible] published by **General Ceramics & Steatite Corp.**, Keasbey, N. J., describes line of steatite insulators.—AVIATION, Oct., 46

Time Switches 22
Automatic Temperature Control Co., Philadelphia, has issued **Bulletin** No. T-[illegible], describing application of time switches developed to meet needs of manufacturers of machines and process equipment.—AVIATION, Oct., '46

Capacitors 23
Catalog No. 193A from **Cornell-Dubilier Electric Corp.**, South Plainfield, N. J., gives specifications on electrolytic, paper and mica capacitors as well as capacitor test instruments and interference filters.—AVIATION, Oct., 46.

Small Switches 24
Technical data, specifications and applications of line of small industrial

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switches are covered in Catalog No. 41 issued by Micro Switch, Freeport, Ill.—AVIATION, Oct., '46

STEELS

Nickel Alloys 25

Booklet published by Carpenter Steel Co., Reading, Pa., contains high nickel alloy chart and engineering and technical data on temperature compensator alloys, low expansion, glass sealing, and high permeability alloys.—AVIATION, Oct., '46

Hardening Methods 26

Surface Combustion Corp., Toledo, O., has issued Bulletin No. SC-131 containing outline of hardening practices and showing types of furnaces for different hardening methods.—AVIATION, Oct., '46.

Tool Steel 27

Catalog issued by Jessop Steel Co., Washington, Pa., contains description and specifications covering standard type "R" tool steel assemblies.—AVIATION, Oct., '46

PLASTICS AND SYNTHETICS

Protective Packaging 28

Applied by means of a spray gun, "Cocoon," new protective coating for machinery and irregular shaped pieces is described in folder from Coatings Div., R. M. Hollingshead Corp., Camden, N. J. It is stated to be moisture proof, bacteriostatic, fungostatic and resistant to mildew and mold groups.—AVIATION, Oct., '46

Plastic Materials 29

Booklet issued by E. I. duPont de Nemours & Co., Arlington, N. J., gives description and applications of line of plastic materials including Lucite, Polythene, Nylon, and Plastacele.—AVIATION, Oct., '46

PLANT SERVICE

Re Magnesium Fires 30

Bulletin No. 11-68 issued by Factory Mutual Laboratories, Boston, Mass., describes tests on fires in magnesium castings, covering test procedure, actual tests, results and the conclusions.—AVIATION, Oct., '46.

Air Conditioning 31

United States Air Conditioning Corp., N. Y. C. has issued Catalog No. 440 describing line of air conditioning equipment, including blowers, exhaust fans, air washers, coil units, unit heaters and air conditioning units.—AVIATION, Oct., '46

AIRCRAFT & ACCESSORIES

Chair Parachute 32

Recent development in parachute equipment shown in folder from Irving Air Chute Co., Buffalo, is a parachute designed and built to form part of seat upholstery in plane. Chute forms back of seat. Upper part of harness is tucked in sides and lower part is stowed in pocket at side. It is stated as available for all types of large and small cabin planes.—AVIATION, Oct., '46

Aviation Fuel 33

Containing charts, graphs and technical information article, "Aviation Fuel Volatility," appears in Vol. 31, No. 7 of "Lubrication", magazine published by The Texas Co., N. Y. C.—AVIATION, Oct., '46

Heated Rubber Items 34

Bulletin issued by B. F. Goodrich Co., Akron, describes how heated rubber units for ice removal or prevention may be applied to various parts of plane including propellers, cowling, air scoops, antenna masts, spinner domes and direction finders.—AVIATION, Oct., '46.

Fuel Pump Test Machine 35

Folder from Greer Hydraulics, Brooklyn, N. Y., contains specifications and schematic diagram of Model FPS3-2 aircraft fuel pump test machine.—AVIATION, Oct., '46

Hydraulic Fuses 36

Designed to act as safety shut-off devices in event of break in hydraulic line, two new type hydraulic fuses, quantity measuring type and return flow type, are covered in bulletin issued by Simmonds Aerocessories, Long Island City, N. Y.—AVIATION, Oct., '46

AIRPORTS

Airport Equipment 37

Airquipment Co., Burbank, Cal., announces new catalog covering line of ground handling equipment and special tools for aviation industry.—AVIATION, Oct., '46.

Hangar Doors 38

Description and specifications of aluminum doors for aircraft hangars are given in folder from Blaw-Knox Div., Blaw-Knox Co., Pittsburgh.—AVIATION, Oct., '46.

MERCHANDISING

Planning Information Manual 39

Booklet from Ken Cook Co., Milwaukee, has been published to give suggestions on what to include in an information or owner manual and how to present data effectively.—AVIATION, Oct., '46

FILMS

Copper Base Alloys 40

Showing development of copper base alloys from discovery of copper to present day use, "Golden Horizons", is new 16 mm. sound and color film being distributed by Ampco Metals, Milwaukee.—AVIATION, Oct., '46

Industrial Films 41

Hathen Productions, Philadelphia, announces two new sound films (16 mm.) "Only a Gasket" (produced for Goetze

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Gasket & Packing Co., New Brunswick, N. J.) shows research and manufacturing technique used in making gaskets. Also produced is "Speed in Cutting" (for A. P. DeSanno Co., Philadelphia) showing use of abrasive cut off machines.—AVIATION, Oct., '46.

Aircraft Manufacture 41

Depicting manufacture of a P-47 from raw materials to finished product, 35-min sound film (16 mm.), "A Thunderbolt is Made" will be distributed by Republic Aviation Corp., Farmingdale, N. Y.—AVIATION, Oct., '46.

Gliders 43

"Gliding Wings" is 16-mm. 25-min sound film (produced by Ford Motor Co., Iron Mountain, Mich.) now being distributed by Association Films, N. Y. C., showing use of glider as a sport, to start science of flying, to development for use in military operations.—AVIATION, Oct., '46.

Carbide Blades 44

Series of five sound slidefilms, single-frame 35-mm productions is being distributed by Kennametal, Inc., Latrobe, Pa., to show use of solid carbide blades mechanically held in tool holding bodies. films were made in connection with Pilot Productions, Chicago.—AVIATION, Oct., '46.

NEW·PRODUCTS

Aircraft Parts & Field Units

Sound Recorder 45

Application is seen for new electronic wire sound recorder, made by Sound Media, N. Y. C., for announcing plane arrivals and departures. By means of photo-electric switch it can be operated as a "talking bulletin board" or be used to warn people away from danger areas.—AVIATION, Oct., '46.

Cigarette Lighter 46

Made to provide greater safety for pilots and their passengers, new airplane popout type cigarette lighter is announced by Casco Products Co., Bridgeport, Conn. Lighter is fitted with a special 12 or 24v element made of nichrome wire and has thermostatic control to give long wear.—AVIATION, Oct., '46.

Gasolator Bowl 47

Approved by CAA, new transparent gasolator bowl now being made by Consolidair, Alliance, Ohio, consists of a Pyrex glass bowl with a metal base and

a poppet type drain valve which permits draining off of sediment without removing bowl. It fits all lightplanes.—AVIATION, Oct., '46.

Wind Velocity Indicator..............48

Consisting of an audio frequency meter which measures frequency of audio pulses generated in anemometer head by interrupting a light beam with a rotating perforated disk, Type S116A remote wind

velocity indicator and recorder, made by Schnttig and Co., Washington, D. C., is stated to respond to velocities of 1 mph with its indications showing a negligible deviation from linearity up to velocities of 150 mph. Accuracy is said to be unaffected by normal line voltage changes and to be independent of vacuum tube characteristics. Recordings may be taken by connecting a standard 5 ma. d.c. Esterline-Angus recorder. Anemometer may be located at a point distant from electronic measuring circuits and its output energy fed to one or several indicating instruments through wire lines.—AVIATION, Oct., '46.

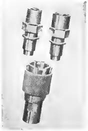
Sun Visor 49

Made of Plexiglas heavy green to insure elimination of glare, an adjustable sun visor for airplanes has been developed by Consolidair, Alliance, Ohio. Visor is 12 x 4 in. and may be clamped to a tube in cabin or screwed to windshield fairing.—AVIATION, Oct., '46.

Headphone Cushions 50

Through research and development in cooperation with aircraft industry, Aviometer Corp., N. Y. C., has developed new type air cooled headphone cushion made of molded heat-conducting synthetic rubber.—AVIATION, Oct., '46

Shop Equipment & Materials



Air Hose Coupling.................51

Incorporating new feature in which coupling body does not have to be disassembled but remains intact while gasket is removed and replaced, new quick connect air hose coupling made by E. B. Wiggins Oil Tool Co., Los Angeles, is said to be leak proof under working pressures up to 1,000 lb. Unit will also handle oxygen, oil, aromatic fuel and kerosene. Coupling body has ¼ in. female pipe threads and is available with or without self-sealing valve. A choice of two nipples is provided, one with ¼ in. male, other with ¼ in. female pipe threads. Unit is made of solid aluminum bar stock, built to aircraft specifications.—AVIATION, Oct., '46

Pressure Pump 52

Incorporating two composition bearings stated to require no lubrication beyond that furnished by liquid being pumped, new vane-type pump, VW-1, has been designed for handling the non-lubricating liquids. Manufacturer is Eastern Engineering Co., New Haven, Conn. By means of new design of vanes and by applying proper radii on the vane edges, vanes are held in contact with pump chamber, requiring no centrifugal force to maintain volumetric efficiency. Pump is designed for use in systems having relief valve and therefore has no bypass valve. Built in shaft sealing is accomp

A COMMONWEALTH TRIMMER gets you where you want to be when you want to be there—for a business appointment or for a hunting or fishing date on some isolated lake.

PITTSBURGH AIRCRAFT FINISHES

help to give COMMONWEALTH'S TRIMMER greater utility and durability

DEMANDS of the war years made necessary development of aircraft finishes which would perform unfailingly under conditions never before encountered.

Pittsburgh's extensive paint research and manufacturing facilities combined with a matchless system of *quality control* met these stern challenges by producing primers, varnishes, dopes, and sealing compounds for every type of requirement.

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In addition to a complete line of aircraft coatings, Pittsburgh offers industrial finishes for every need.

For many years, Pittsburgh has served successfully many branches of American industry, as its long list of satisfied and continued users attests. This practical knowledge has contributed materially to the improvement of production.

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Top speed—135 mph

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Cruising range—up to 500 miles.

Climb—850 feet per minute.

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First twin-engine ship of less than 1,000 h.p. which can actually fly on one engine.

New type hull construction—responsible for light weight—only 1550 pounds, empty

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Protective Coatings for wood and fabric surfaces .. Zinc Chromate Primers for metal ... Lacquers, Clear and Pigmented ... Dopes, Clear and Pigmented ... Sealers and Surfacers for wood ... Plywood Finishes ... Paints ... Spar Varnishes ... Heat-resisting Enamels ... Slushing and Sealing Compounds for fuel tanks ... Caulking and Glazing Compounds ... Chromseal Ribbon Compound ... Fabseal Impregnated Tape ... Chromseal Tape ... Strutseal Cabin Sealing Tapes ... Army and Navy Specification Finishes.

PITTSBURGH PLATE GLASS COMPANY, Industrial Paint Division, Pittsburgh, Pa. Factories: Milwaukee, Wis., Newark, N.J., Houston, Texas, Los Angeles, Calif., Portland, Ore. Ditzler Color Division, Detroit, Mich. The Thresher Varnish Co., Dayton, O.

PITTSBURGH *Industrial* FINISHES

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lished by means of a mechanical rotary seal. Delivery approximates ½ gal. per minute. Pump is suitable for operating pressure of from zero to 30 psi and is self priming. Universal motor is 1/15 hp and is available in either 110 or 220 v, a.c. or d.c.—**AVIATION, Oct., '46**

Prop Hub and Regulator Test Rig ... 53

Hydraulic Machinery, Dearborn, Mich., announces Model T-183 combination propeller hub and regulator rig designed for checking Aeroproducts propeller Models A 642 G1 and A 642-G2. Functions of test units are to test the hydraulic actions of

variable pitch propellers. Tests performed on test regulator unit are: Pressure control valve opening, pump flow, maximum control speed of governor, governor sensitivity, and external and internal leaks. And on hub test: External and internal oil leaks, general operation, and rate of pitch change. Propeller hub is mounted on semi-steel surface plate and is designed to rotate propeller blades 360 deg while under pressure to check propeller track. Surface plate has scribed markings for checking blade angles at stations indicated by manufacturer.—**AVIATION, Oct., '46**

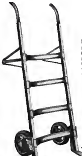
Work Positioner 54

Developed by **Bullard Co.,** Bridgeport, Conn., to be used on manufacturing operations involving drilling, tapping, reaming, and boring, new Man-Au-Trol spacer or work positioner is comprised of a hydraulically operated flat platen which in turn is mounted on a carriage and base, so that it is possible to move platen both longitudinally and transversely. In operating, a final position of table in any given setting is reached by a selected pair of pistons, one controlling each direction of motion, coming in contact with their individual adjustable positive stops, and being locked in this position by action of a master control piston acting along each axis. Settings are made by adjustment of screws controlling multiple longitudinal and cross positions of table. When once set, platen will repeat to its prearranged settings. Indexing table from one position to next is accomplished by two handwheels, controlling respectively lengthwise and crosswise motions of table, into dial reading corresponding to desired position of table. Units are made in two sizes, larger one suitable for use under radial drills and smaller unit under sensitive drills.—**AVIATION, Oct., '46**

Temperature Control Unit 55

Housed in a cast aluminum case 8¼ in. high, 6½ in. wide, and 3 in. deep, and designed for surface mounting, new temperature control made by **Clend & Gordon Co.,** Chicago, is stated to provide temperature variation control as low as 0.2 deg and power off and on cycles

as short as 3 sec. It has been designed for use in plastic work, molding, tempering, aluminum heat treating, and other processing work on electric furnaces, ovens, and injection molding machines employing millivoltmeter and potentiometer type controlling pyrometers or gas



Bond General Purpose Truck

For warehouse, shipping room, loading platform—anywhere in the plant. Wheels, set inside frame, turn freely—won't catch on bags or other obstacles. Round, cold rolled steel axle easily replaced. Parallel sides add efficiency to handling of cases and barrels.

Materials flow smoothly, safely, efficiently on these Bond handtrucks. Each of this husky trio rolls easily... withstands hard usage. Bond's long experience as specialists in materials handling equipment is your guarantee of dependability.

Write today for additional information on these trucks.

BOND FOUNDRY & MACHINE CO., MANHEIM, PA.

Bond Keg and Case Trucks

Two sturdy, well-constructed trucks at an unusually low price. Both made of 1-inch square high-carbon steel tubing. Can be equipped with plain or roller bearing semi-steel or rubber tread wheels.

No. 4691—The Truck with a Thousand Uses

No. 4692—With Stunt Guards for Handling Bags

fied equipment using solenoid controlled or motor operated valves. It has no rotating mechanical parts.—AVIATION, Oct. '46

Die Jacks 56

Designed to separate die sets new die jack made by Persson Mfg. Co., Bloomfield N J, enables operator to elevate punch holder and to lower it in same

manner Clamp block is one piece heat-treated aluminum alloy Operation steps are Clamping jack to holder turning screw to raise lifting off die holder.—AVIATION, Oct., '46

Portable Electric Hand Lamp 57

Having a single-focus type adjustment whereby it will either deliver a spot or spread light, and stated to throw a 1,500 foot beam new portable electric hand lamp, Model No 211, is made by U-C Lite Mfg. Co., Chicago It is powered by two standard drycell batteries with pressure type connections, weighs 7 lb and can be set down anywhere or clamped in a special hold down fixture It should be ideal for use in aircraft.—AVIATION, Oct., '46

Recording Dilatometer 58

Designed to provide continuous graphic recording of 1½ hr expansion and contraction cycles of samples, automatic dilatometer for recording thermal condition of various materials including metals glass ceramics, and plastics has been developed by Electronics Div., Sylvania Electric Products, Inc., N Y C Recording without supervision of operator It is stated to permit determination of true variations in length when samples exhibit exceptions to rule of elongation as function of temperature Unit includes a furnace or sub-zero cooling chamber furnace thermocouple, concentric quartz tube specimen thermocouple, gear box and support transmission contact mechanism electronic relay and recorder It is stated to hold specimen temperature uniform within 1 deg C. to provide uniform heating and cooling with specimen in inert atmosphere to have automatic shut-off, and to have overall accuracy of 0.2% Accommodating 3, 4, or 5 in specimens, dilatometer will handle temperatures up to 1,000 deg C weighing 450 lb., and 56 in wide 50 in high, and 80 in deep, it is designed for use at 110-120v, 50-60 cycle supply and is rated at 800 to 1,000 w.—AVIATION, Oct., '46

Liquid Absorbent 59

Produced from an alumina silicate material and stated to be capable of absorbing from 120 to 140% of its own weight, a new oil, grease, and water absorbent has been announced by Blue Mountain Clay Co., Memphis, Tenn It is made to eliminate danger of accidents due to slipping, at same time keeping floors clean and minimizing chances of flash fires. Material is granular and is stated to be free of dust and non-abrasive It weighs up to 36 lb cu ft.—AVIATION, Oct. '46

Cleaning Machine 60

Manufactured as a stationary unit with base as a movable unit with casters, or as a trailer-carried unit new vapor steam cleaning machine, designated Model MO 40B for cleaning plane fuselages and for stripping paint announced by White Engineering & Mfg. Co., Rochelle Park, N J Two valves enable one man to op-

erate machine and pressure. The adjustment of mixture is made by one valve, which permits regulation from full concentration of cleaning compound to clear vapor for rinsing. Another feature of unit is system of electric ignition. Operating pressures are 75 to 125 psi with normal pressure of 100 lb. Operating parts of machine are one subassembly which can be removed for maintenance. Cleaner burns No. 1 fuel oil, kerosene or light oil and can be used with any high grade steam cleaning material. Standard models are equipped with ½ hp 110v 60-cycle a-c motor with 8 ft drop cord. Overall size is 18 x 18 x 48 in., weight is 355 lb., and capacities are: Machine 180 gal per hour, fuel tank, 11 gal., compound tank, 15 lb.—AVIATION, Oct., '46.

Die Cushion 61

Mounted on bottom of bolster plate of punch press, pneumatic die cushion made by **Dayton Rogers Mfg. Co.**, Minneapolis, has bellows type construction and is stated to maintain air pressure after die cushion is charged to predetermined pressure recorded on furnished pressure gage. Press bed mounting allows operator to remove bolster plate without disturbing cushion installation. Unit is provided with a hardened and ground pin pressure pad height of which is maintained by handwheel. This is stated to make it unnecessary to correct pin pressure pad pins for length, thus compensating for bolster plate thickness variation, sharpening and grinding of dies, or change in die design. Synthetic bellows is designed to automatically shed cushion unit so that no pierced slugs or other parts come in contact with any of cushion unit's working parts. New Model L is now made in sizes 5 to 14 in., having ring holding pressures from 1 to 8 tons.—AVIATION, Oct., '46.

Inspection Mirror 62

Use is seen in aircraft industry for new "Vanco" inspection mirror made by **Van Wagner Co.**, Richmond Hill, N. Y., for inspection of internal wing construction, threaded area of bolt in inaccessible sections, bolt and nut for cotter pin alignment, points of rib attachment to spar, auxiliary spars and longerons, instru-

ment panels, control pedestals, control surface Flettner mechanisms, and engine work. Mounted on adjustable extension, instrument has hinge in center for adjustment of mirrors. Size of each mirror is 1½ x 1½ in.—AVIATION, Oct., '46.

Alloy Selector 63

Made in form of slide rule, aluminum alloy selector, giving technical information concerning 18 alloys, is being marketed by **Reynolds Metals Co.**, Louisville, Ky. Main horizontal slide is pulled to line up with alloy under consideration. Chart reads directly chemical composi-

tion in percent for twelve elements and shows physical constants including specific gravity, density, modulus of elasticity in tension and torsion, coefficient of thermal expansion, thermal and electrical conductivity and specific heat. Data are also given on maximum forging temperature, recommended cycles for solution heat-treatment, as well as precipitation heat-treatment and annealing. By moving a second slide vertically to line up with seven different product forms, chart shows tempers available in that product form, ranges of tensile strength, yield strength, hardness, and elongation. Also included is an explanation of alloy and temper designations and a short description of principle properties of each alloy. Slide chart measures 8½ x 11 in.—**AVIATION, Oct., '46**

Parts Duplicator .64

Having larger material capacities than former models, new parts duplicator designated as "Di-Acro" Brake No. 4 made by **O'Neil-Irwin Mfg. Co.**, Minneapolis, has material capacity of 16 gage sheet metal and a maximum forming width of 24 in. Features of new unit: Special ma-

terial clamping action, double edge vertical folding plate, Torrington roller bearings, adjustable material gage and angular degree stops. Unit weighs 285 lb. and will accommodate such materials as copper, bronze, stainless steel, aluminum, bi-metals, sensitized materials, varnished cambrics and dielectrics.—**AVIATION, Oct., '46**

Pressuregraph 65

Designed to provide, with a cathode ray oscillograph, a linear pressure-time curve on screen to indicate performance of any engine, pump, or other device subject to pressure variations, new pressuregraph is made by **Electro Products Laboratories**, Chicago. It may be used for studies of all types of internal combustion engines, pumps, compressors, air and liquid pipe lines and in aviation field for C.F.R. aviation fuel test engines. In addition to dynamic pressure variations, it shows static or slow pressure variations and covers all mechanical speeds, and pressures up to 10,000 psi. Instrument provides means for temperature compensation and has three output selections: For double modulated wave, for indicator card wave, and for integrated single line providing means for transmission of pickup response to a string oscillograph for photographic recording.—**AVIATION, Oct., '46**

Oscillograph 66

Developed for routine laboratory and production testing, Type 274 cathode ray oscillograph, announced by **Allen B. Du Mont Laboratories**, Passaic, N. J., is equipped with 5BP1-A 5 in. tube and is 14 in. high, 8¾ in. wide, and 19¾ in. deep. Linear time base has range of 8 to 30,000 cps. Synchronization may be from vertical amplifier or an external signal. Identical vertical and horizontal amplifiers have a range from 20 to 50,000 cps. There is provision for intensity modulation.—**AVIATION, Oct., '46**

Resin Glue 67

Developed for joint assembly operations by **National Adhesives**, N. Y. C., new cold run resin wood glue "Wood-Lok" is stated to have clamping time of only 20 to 30 min. before it can be handled and machined. Nothing is added

They make the lubricant last longer...

Yes, whatever the load, speed or service requirements of the installation, Torrington Needle Bearings help conserve lubricant... prolong its effective life.

That's because there is an extra margin of lubrication efficiency in Torrington Needle Bearings due to their basic design... *the turned-in lips of the hardened retaining shell which provide a natural reservoir for retention of the lubricant.* At the same time this same feature helps to exclude dirt and dust from vital bearing surfaces. The lubricant is kept clean and free from contamination. Consequently, bearing wear is minimized ... less frequent renewal or replacement of the lubricant is required ... maintenance costs are substantially reduced.

If you are seeking an anti-friction bearing for an application where high capacity, small size and economical cost are important design considerations, Torrington Needle Bearings may be *your* answer! You'll find a wealth of pertinent data in our Catalog No. 32, available on request. If you have a specific application in mind, our engineering department will gladly give you specific recommendations.

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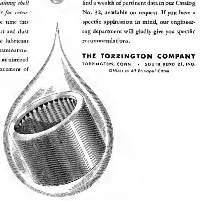

TORRINGTON NEEDLE BEARINGS

soaked, or heated, and it is said to remain liquid in pot and not to change during shipment, application, or use. It has no odor. Maker says there is no need to heat wood or glue or to heat room above ordinary working temperatures, also that glue does not dull saws or knives. Its colors range from white (which dries colorless) to darker shades for special uses.—AVIATION, Oct., '46

Gear Testers 68

Having a maximum capacity of 18 in. center distance, two new models of gear testers are announced by **George Scherr Co., N. Y. C.** One has box shaped upright carrying adjustable bracket with means for clamping it in any desired position. This arrangement provides vertical centers for holding gears or pinions that are cut intergral with their shafts or mounted on arbors. Other model has been designed for testing internal gears against either a mating pinion or a master. Operation is by handwheel through rack and pinion. Recording attachment is available (in addition to dial indicator) as optional equipment on both models.—AVIATION, Oct., '46

Dense Alloy 69

Produced by powder metallurgy and having high density of 17.3 gr./cu.in., alloy No. 118 made by **Cellite Tungsten Corp., Union City, N. J.**, is available in round, square, or special shapes. Alloy can be machined by ordinary methods. It also has application in balancing weights where space is a prime factor.—AVIATION, Oct., '46

Electric Hoists 70

Now made in 2-ton model, "Midget King" electric hoist made by **Yale & Towne Mfg. Co., Philadelphia**, is equipped with 1 hp. motor and has one hand bar-grip control for lifting and lowering action. Roller chain is alloy steel. Load hook is of special steel to provide maximum safety for both load and operator. Upper and lower limit safety stops prevent overtravel of hook. Load brake and independently acting motor brake operate whether power is off or on. Brakes, all wiring and controller are enclosed. Shaft and gears are of forged and hardened alloy steel. Frictional parts have oil bath lubrication. Unit is available with hook for stationary use and with trolley attached for use on an overhead track.—AVAITION, Oct., '46

ANNOUNCEMENTS —

of new machinery, shop equipment and materials, electrical appliances and aircraft parts and field units are invited.

In writing, emphasis upon specific aviation applications of newly marketed items is desirable. Also, whenever possible, glossy-print photos should be enclosed. Please do not send electros. Address —

New Products Editor, AVIATION 330 W. 42d St., New York City 18

This New Onan

FLOODLIGHTER

NIGHT OPERATIONS are easier, faster, safer ... with the mobile Onan Floodlighter. Special dolly mounting permits quick hitching and high-speed towing. On location, the Floodlighter is easily moved, operated and serviced by one man.

Three 1000-watt lamps, enclosed in spun aluminum reflectors, provide brilliant illumination for airport runways, loading ramps, aprons, outdoor depots and construction sites.

Rugged, weatherproof, sheet-steel housing protects the 3000-watt A.C. power plant. The prime mover is an Onan air-cooled gasoline engine direct connected to the generator for maximum compactness and permanent alignment. Quick and sure push-button electric starting.

Motor-driven tools and auxiliary lights plug-in directly at the four outlets mounted on a recessed panel.

Standard Equipment

FLOODLIGHTS Three; height adjustable to 8½ feet. 360 degree horizontal arc, wide vertical arc.

ENGINE: Onan 2-cylinder 4-cycle air-cooled.

GENERATOR 4-pole, self-excited, inherently regulated.

DOLLY MOUNTING Two ball-bearing steel-disc wheels 6 x 15, four-ply pneumatic tires, ball trailer-hitch deadstands.

STARTING Electric push-button; batteries supplied.

•

ONAN Electric Plants are available in many sizes and models.

ALTERNATING CURRENT: 350 to 35,000 watts in all standard voltages and frequencies.

DIRECT CURRENT: 600 to 10,000 watts, 115 and 230 volts.

BATTERY CHARGERS: 500 to 3,500 watts; 6,12,24 and 32 volts.

D. W. ONAN & SONS INC.
3162 Royalston Ave. Minneapolis 5, Minn.

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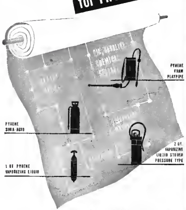
BLUEPRINT for Fire Protection



As long as there is one spot in your business not amply protected from fire your whole investment is in danger. Specific protection for individual risks should be your guide in planning all-around safety for your business

Pyrene provides an extinguisher for every type and size fire, the Vaporizing Liquid extinguisher for electric equipment, motors, flammable liquids or automotive vehicles...Soda-Acid or Water-Type for ordinary combustibles—wood, paper and textiles in stores and offices . . . Pyrene Foam for gas, oil, paints, dopes, solvents, and ordinary combustibles and Pyrene Foam Playpipe and Foam System for producing hundreds or thousands of gallons of foam for big fires.

If your protection is inadequate or if you plan to expand, consult your Pyrene jobber. Our engineers are at your service to give you expert advice on protecting your properties

Pyrene Manufacturing Company
NEWARK 8 NEW JERSEY
Affiliated with the C-O-Two Fire Equipment Co.

Grinding Wheel 71

DoAll Co, Minneapolis, has announced new unit stated to grind hardened alloy tool steel, annealed steel stainless, Monel bronze, aluminum, brass, and hard plastics, to work equally well for heavy, fast roughing cuts and fine finishing, and to produce a finish comparable to that of a 300 grit wheel. It can be used on various types of grinding machines including surface centerless and cylindrical grinders. No alteration is necessary and cutting rate is said to be limited only by capacity of machine. Types of wheels available are straight, recessed one side and recessed two sides. Sizes range from 1 to 14 in. dia. by ¼ to 3 in. thick—AVIATION, Oct., '46

Portable Fire Extinguisher 72

Designed for use against small fires in flammable liquids and electrical equipment portable extinguisher in a new cylinder is announced by **Walter Kidde & Co.**, Belleville, N. J. New model increases CO_2 content 25% and decreases weight by 21½%. It has trigger control valve.—AVIATION, Oct., 46

Electrical Appliances

Thermostat 73

Pre-set to the customer's temperature specifications, this new sealed thermostat, "Mighty Mite", designed in size and shape for electrically heated garments is announced by **Mechanical Industries Production Co.**, Akron. Having ⅛ in spun-in silver contacts, it is stated to be tamperproof, dust and waterproof. It can be molded in rubber and various plastics, and has Fiberglas insulation to protect it from humidity and freezing weather. Standard model is pre-set for 200 deg. and is designed for use up to 300 w., 110v., or 150 w., 220v., a.c. non inductive load. Other models are available for settings up to 600 deg.—AVIATION, Oct., '46

Circuit Tester 74

Designed for use in modern electronic laboratory for radio receiver and transmitter service, industrial maintenance and production testing, new 41-range panel-mount a.c.-d.c. laboratory circuit tester, incorporating a 9 in. rectangular 5,000-ohms-per-volt meter, and designated as Series 884, is announced by **Precision Apparatus Co.**, Elmhurst, N. Y. Providing functions of an a.c.-d.c. voltmeter, ohmeter, milliammeter, ammeter and decibel meter, it is housed in a standard 12¼ x 19 in. panel with enclosed rear dust cover and is designed for standard relay rack mounting. Selection of ranges is provided up to 6,000v a.c. and d.c., 20 megohms, 12 amp., 70 decibels.—AVIATION, Oct., '46

Electrical Test Units 75

Airquipment Co., Burbank, Cal., has made available to aviation industry three electrical test units. Electrical aircraft analyzer is made to simultaneously check

what's your need in SIZE?

Globe seamless steel tubing is made hot finished and cold drawn in alloy and carbon steels in sizes from ½ inch to 6⅝ inches outside diameter.

Globe seamless stainless steel tubing is available in tube sizes from ½ inch to 6⅝ inches outside diameter and in pipe sizes ⅛ inch to 6 inches, standard, extra strong and double extra strong weights.

Gloweld (electric welded) stainless steel tubing may be had in sizes ranging from ⅜ inch to 4 inches outside diameter inclusive, and in standard weight pipe sizes ⅛ inch to 2 inches, inclusive.

Your tubing needs may lie somewhere within the above ranges — whatever your requirements, Globe is qualified by experience and facilities to supply you with tubing of the quality and uniformity you demand.

GLOBE STEEL TUBES COMPANY, Milwaukee 4, Wisconsin

GLOBE TUBES

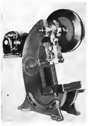
★ STAINLESS STEEL TUBES ★ PRESSURE TUBES ★ GLOBEIRON TUBING ★ GLOWELD TUBES
★ CONDENSER AND HEAT EXCHANGER TUBES ★ MECHANICAL TUBING

generator voltage, field current regulator, generator relay, instruments, and wiring of single and multi-engined planes. It can also be used as a d.c voltmeter with 30, 600 and 1,500V range as well as a 60 and 300 amp ammeter. Aircraft voltage regulator is designed to balance generator output on multi-engine planes. Instrument is stated to have 2% base accuracy plus a sensitive adjusting mechanism which permits synchronization and is reported to eliminate danger of boiling new batteries. A pocket size electrical tester unit is made for checking voltage, current, resistance and continuity. It provides a d c voltmeter with 0 to 30v, a d c ammeter with 0 to 30 amp, an ohmmeter with 100 ohms full scale and 5 ohms center scale, a continuity test light, a 3v internal battery and a 28v light for hunting hot circuits.—AVIATION, Oct. '46.

Battery Charger 76

Rated at 6 amp and delivering an initial charge of 8 amp on a discharged battery which automatically tapers to about 3 amp at full charge, new 12v battery charger designated X6DF made by **Mallophone Corp**, Rochester, N. Y., operates on 110v, 50-60 cycles a.c., and models are available for 220v, 50-60 cycles. It uses selenium rectifying plates, has no moving parts, and is stated to withstand a 50% overload.—AVIATION, Oct. '46.

Machinery & Accessories

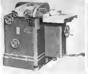


Punch Press 77

Operating at a speed of 285 rpm with a 1,725 rpm electric motor, new model 4-ton bench punch press designed by **Benchmaster Mfg. Co.**, Los Angeles, has notable features including ground shaft keyed by means of press fit to eccentric, oversize bronze bushing enclosing eccentric and full dia. bronze bushings encasing shaft at wear points. Frames are cast in one piece from semi steel, heat treated and re-enforced at stress points and are mounted on two supports forming stand cradle which allows machine to be inclined for various operations. It has open back permitting work to be inserted from front as well as from sides and has floating motor to maintain tension on V-belt drive. With ram up 5⅝ in. die space is available. Bolster plate is 6 x 8 in. and has 1 in. thickness with 2 in. hole in center. Fly wheel weight is approximately 50 lb.—AVIATION, Oct. '46.

Two-Spindle Borer 78

Incorporating enclosed top which permits movement of head to any position in a 90 deg. arc and adjustment of spindles from 1 1/16 to 15 in. apart, two-spindle radial borer, designed to meet demands



of plastics and light metals industries is now in production at Monk Machine & Tool Co., Port Huron, Mich. Right hand spindle is stationary while left hand spindle is adjustable, and their speed can be varied from 1,000 to 4,000 rpm. Foot treadle has quadrant arrangement allowing cables to move table in straight line. Opening through which movable spindle travels is enclosed. Top is made of heat treated alloy aluminum. Indicator and pointer show degree of setting.—AVIATION Oct., '46

Oil Company Aid

(*Continued from page 47*)

oil companies on their local problem.

One company—Socony Vacuum—developed a movie called, "Ceiling Unlimited" which met with approval of many CAA officials and was used to guide various city, county and state planning commissions.

Another, Shell, developed a personalized brochure entitled, "The Airport" which was presented to Mayors in some 800 communities. It came as the climax of a talk made by Shell men and was designed to present in simple terms the best of current thought on preliminary selection, design and financing of small airports.

Standard of New Jersey, along the same line, issued a booklet entitled "Community Airports" and distributed it to communities of over 2500 population. Also, men from this company gave many personal talks to civic groups.

During the last year, results from this promotional work have poured in. Socony Vacuum alone claims that the number of its airport outlets has jumped from around 100 on V-J day to 1,000 currently. Mr. Long explained that his company was not alone in this expansion. All companies selling oil have profited by the tremendous activity in the aviation field since the war. Just how much of this was due to their wartime programs is anyone's guess. But most executives feel that these programs have more than paid for themselves.

Gulf, Esso, Shell, Texaco and many others have experienced a sharp increase in the number of new outlets they have recently signed up. These are drawn from two main groups. Many old operators who were shut down during the war are opening up

anew, but about half of the accounts are with men new to the business.

For these new accounts the oil companies have developed manuals aimed at pointing out a few facts of business life for the airport operator. Socony Vacuum calls its manual, "The Airport Program Work Manual". It discusses the realities of aviation gasoline merchandising and general airport operations based on that company's experience since the days of Kitty Hawk.

Customer service, the petroleum producers maintain, is the key that opens the door to successful airport operation. Executives of all major oil companies believe their plans for customer service will be the basis of the oil industry's main contribution to the future of aviation in the light aircraft field.

Currently, Aubrey Keif, sales manager for Texaco, finds service and sanitary conditions for the private flyer shockingly offensive, a problem that all executives feel it is their business to face and help rectify.

Some companies are operating model airports at which they can find out first hand what's wrong with aircraft service for lightplanes and what their dealers can do about it. For example, Paul Galea, Seaport Base Manager for Gulf at 23rd St. in New York City says, "I fail to see why we in aviation can't give service in every way comparable to the best that auto service stations have to offer and then some." Since the Gulf service station reopened Galea claims that his corps of uniformed port attendants have often been favorably compared with auto service station attendants by customers.

Weather service is one of the aids being instituted at this base, windshield wiping and other routine service come as a matter of course.

While it is true that oil companies will finance operations they feel will be successful, the foundation of their nonscheduled airport program is one of helping the individual airport operator learn to give better service, a tried and proved method of boosting sales.

Recent Books

(*Continued from page 99*)

are trouble-shooting notes for determining why past conferences have not achieved results.

CAREERS IN AVIATION, by Samuel Burger. Greenberg Publisher, N. Y. C. 209 pages. $2.75.

Writing in a brisk style, author covers varied jobs in field of aviation, from airman to radio operators, dispatchers to meteorologists, airport maintenance men to station directors, advertising managers to ticket agents, etc. Helpful information is also included concerning

aviation jobs in government careers in military branches. In addition there is a chapter on launching out for oneself as an independent operator.

THE MODEL AIRCRAFT HANDBOOK by William Winter. Thos. Y. Crowell, N. Y. C. 345 pages. Illustrated. $2.50

Mr. Winter does an excellent job in this revised edition with inclusion of more of those interestingly detailed perspective and cutaway drawings of gas models so popular with enthusiasts. Every phase of model building—radio control, tether flying, gas-powered land and seaplane and rubber powered craft are covered and explained. Plans for 18 new record type craft are also given. There is also a glossary of model aviation terms.

THE RCAF OVERSEAS—THE FIFTH YEAR Foreword by Col. Colin Gibson, Minister of National Defense for Air. Oxford University Press, N. Y. C. 404 pages. Illustrated. $3.00

As in preceding volume, *The RCAF Overseas—The First Four Years*, events recorded here symbolize whole body of courageous Canadian youth serving in RCAF. Covering period of Sept. 1943 to Aug. 1944, it essentially deals with operations by squadrons overseas. Among numerous accounts is dramatic story of F/L David Ernest Hornell, first RCAF airman to be awarded Victoria Cross.

Tagging the Bases

(*Continued from page 89*)

in which students receive 25-50 hr. dual and solo flight time in addition to 10 hr. ground school instruction. . . . A 20 yr. lease of ground at Grandview Airport, Kansas City, has been taken by Security Aviation Sales & Service Co., which plans to erect $35,000 hangar and shop building. . . . City authorities have decided to enlarge Denver (Col.) municipal airport from present 1,360 acres to 2,000, permitting extension of east-west runways from 7,000 to 10,000 ft.

Sixth Region—J. H. Engel, Escondido, Cal., expects to complete airpark this Fall consisting of 6,000-ft. runway, 100 T-hangars, residential lots, rustic restaurant and recreation center, riding academy, midget race track, trailer camp, maintenance, overhaul and flight school, sales facilities, and salesrooms for automobiles, tractors and farm implements. . . . Univ. of Southern Cal.'s College of Aeronautics, Hancock Field, Santa Maria, plans open house and free air show Oct. 12 and 13. . . . Second annual Arizona Aviation Conference has been scheduled for Oct. 24-26, in Phoenix. . . . Facilities at Buchanan Field, Contra Costa County, Cal., new civic airport, are now open to all private plane owners. . . . At press time, curtain was going up on Western Aviation Conference at Reno, Nev. . . . San Diego County's airport advisory commission has approved 18 new airports from which planes operate in control of forest fires. Fields will be located at Campo, Escondido, Fallbrook, Oak Grove, Warner Springs, Palomar Mt., Tule Springs, Descanso, Sky Valley, Laguna, Dulzura, Alpine, Julian, Ramona and Cameron Meadows. . . . Army airports at Redding and Lincoln, Cal., have been turned over to city and county governments by WAA under interim permits allowing them to "use, maintain, and operate" field without cancelling War Dept. lease. . . . Siskiyou County, Cal., supervisors have budgeted funds for construction of hangars and administration building on $2,500,000 former Army airport near Montague.

Seventh Region—National Assn. of State Aviation Officials was scheduled to hold annual meeting at Hotel Finlen, Butte, Mont., as we went to press. . . . Multnomah Flying Club, Portland, Ore., celebrated sixth anniversary by purchasing Aeronca Chief and a two-control Ercoupe. . . . Organization of Southern Idaho-Eastern Oregon Aircraft Operators' Assn. was completed Aug. 14 at Gooding, Ida., with 24 charter members. Designated directors were H. Clark, Nampa; Bill Ludwig, Caldwell; Jack Medlin, P. Cox, L. Eason of Boise. . . . Flying Farmers of Ore., Wash. and Ida. were to meet in Spokane, Wash., late last month to outline state organization's plans. . . . Recently, about 200 pilots dropped in on Oregon City's new Skypark airport for breakfast and round of golf. Airport claims distinction

of being only field in Northwest with "built-in golf course." Sportsman pilots can land on 2 700-ft. runway and taxi directly onto golf course. H. Anele is pres. of Oregon Sportsman-Pilots.

Comfort can be compatible

(*Continued from page 59*)

tion, but a continuation of lift well beyond ordinary angles at which conventional combinations stall by abruptly losing their lifting force (Chart II). Aircraft designs such as this one having "flat-top" lift curves usually show no tendency to stall or spin. When properly conformed to the wing curve, the body will contribute considerably to the lift of the wing. Even the shorter-chord higher-aspect-ratio wings show up better in the high position on a fuselage.[5] The result of these design considerations is shown in the three-view drawing, Fig. 6.

Many new types of power units will be available for small planes in the near future, judging from numerous experimental developments leading to lighter, cheaper, and less complicated engines and propeller combinations. The turbine-jet engine principle offers many interesting possibilities, as does also the recently announced "pinwheel" type of jet-driven propeller. Small steam turbines afford attractive possibilities and may yet be the means for providing small aircraft with highly efficient propulsion units. They can be designed to burn cheap fuel and need not be of complicated construction. Furthermore, there is every indication that future engines will weigh considerably less than 200 or 300 lb, resulting in a larger useful load.

Until these more advance propulsion ideas progress beyond the experimental stage, airframe designers will have to be content with existing conventional high-cost engines. However, by logically anticipating the inevitable trend, particularly toward pusher installations, they will be prepared to substitute the new engines without having to completely redesign their planes.

To power the plane as it is designed, an engine developing around 200 hp is required for optimum performance. A smaller engine could be used and still obtain superior performance, but 50 hp or so less is not worth the difference in performance compared to using the more powerful engine. A most promising power unit is General Motor's "X" type 200 hp liquid-cooled engine, upon which the plane performance is calculated assuming the use of an automatic pitch propeller (Chart III). Weights are also calculated on the basis of this power plant (Chart IV), with space allowed within the body to accommodate it and the propeller reduction drive.

Not much can be revealed at this time regarding detailed design of either the landing gear or the flight controls, because of the patent situation as it relates to them. It can be said, however, that flight operations concerned with taking off and landing the plane can be made nearly fully automatic. Certainly there is no logical reason why most of those functions the pilot performs manually cannot be done by automatically controlled mechanisms set in motion by merely pressing a button on the control board. The pilot would then be permitted to devote full attention to supervising the flight path when approaching or leaving the ground. Moreover, radio-controlled flight between destinations will greatly simplify avigation.

With all of these suggested improvements in private planes, the future will see long personal flights become commonplace—flights no longer beset by difficulty and danger.

[5] *Report 540—Interference of Wing and Fuselage From Tests of 285 Combinations in the NACA Variable-Density Tunnel*, by Eastman N. Jacobs and Kenneth E. Ward, 1935, p. 11.

AVIATION INFORMATION SERVICE — **OCTOBER 1946**

For more information on any products or services advertised in this issue, indicate below the key or reference numbers which appear before each name listed in the Advertisers Index. This can be found in back of book.

Name .... Title ....

Company ....

Address ....

Foam in a sandwich makes a finer floor for flight

IF 200,000 high heels were to walk over an airliner's floor, how many times would it have to be replaced? Three times? Five times? Some maintenance men might say even higher, because floors that are light enough for flight couldn't be made tough enough for impact like that. Weight concentrated on a small point (like a high heel) is especially troublesome ... punches holes and makes for frequent replacement.

Not so with a new B. F. Goodrich flight floor material. A section of it installed on a 10-degree ramp in the B. F. Goodrich offices last December has been taking the pounding of approximately 2000 low and high heels a day plus the punishing wheels of 44 mail trucks. Other flight floor materials in this same test had to be replaced three times, but the B. F. Goodrich floor material still continues to "take it". The secret of its success is "foam sandwich" construction.

The sandwich (see inset) consists of a core of a new, lighter, stronger hard rubber foam between thin skins of high strength materials. The result is a lighter weight board with greatly increased load strength and resistance to indentation.

One of the most important characteristics of this material is its extremely low moisture absorption, which means that the sandwich does not gain weight in service.

This favorable weight-strength ratio, the easy workability of the material, open it to many potential uses besides floors. Strong, lightweight panels, doors, furniture, including curved surfaces, can be made with it. For additional data, write to *The B. F. Goodrich Company, Aeronautical Division, Akron, Ohio.*

B.F.Goodrich

FIRST IN RUBBER

RUGGED, ACCURATE, LIGHT-WEIGHT MOTORS AND SYSTEMS TO GIVE REMOTE MANUAL OR AUTOMATIC CONTROL..

Barber-Colman

MICRO CONTROLS *for* AIRCRAFT

Type FYLC CONTROL MOTOR. Maximum torque, 50 lb. inches. Approximate weight, 2¼ pounds. Available with or without right-angle drive.

Type BYLC CONTROL MOTOR. Maximum torque, 500 lb. inches. Weight, 3 pounds 4 ounces. Available with or without right-angle drive.

This equipment is *specially designed and built* for aircraft service. Note light weights, small sizes, and high torques indicated by brief specifications here. Barber-Colman Aircraft Controls *proved their ability* to perform accurately, reliably, and efficiently during the war. You can use them now for control of CABIN TEMPERATURE . . . ANTI-ICING TEMPERATURE . . . CARBURETOR AIR TEMPERATURE . . . CARBURETOR MIXTURE . . . CARBURETOR THROTTLE . . . and other similar purposes. *Write for further information.* Look for Barber-Colman Controls on the Leading Luxury Airliners!

Type EYLD REMOTE BULB THERMOSTAT. Weight, including bulb and tube, 1 lb. 2 oz. Dimensions, 3¼" x 3½" x 1-5/16"

Type CYLD (far right) SINGLE ELEMENT CABIN THERMOSTAT. Weight, 7 oz. Dimensions, 3¼" x 3½" x 1-5/16".

Type AYLZ (right) MICROPOSITIONER. Super-sensitive polarized relay for control circuits. Weight, 6 oz. Dimensions, 2-5/16"x1-7/8"x1-7/16"

BARBER-COLMAN COMPANY · ROCKFORD, ILLINOIS, U.S.A.

An Improved Ignition Harness for R-2000 Engines

with STEEL MANIFOLD
STEEL SPARK PLUG ELBOWS
FLEXIMOLD IGNITION LEADS

AMERICAN AIRLINES Standard Equipment on all DC-4 Planes

YES! Another leading commercial airline has standardized on Titeflex Ignition Shielding products. This time it's American Airlines, who have adopted a newly designed harness of Titeflex manufacture for R-2000 engines.

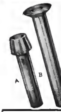
Designated by Titeflex part No. D-30119, this continuously wired harness provides a steel manifold of maximum strength in combination with Titeflex "Fleximold" rubber molded spark plug leads.

Fewer flight interruptions from ignition causes have characterized the design of all Titeflex assemblies. Greater fatigue resistance and maximum radio shielding qualities are found in this particular assembly. Complete harnesses for R-2000 engines are available with both 5 MM and 7 MM cable, wired for clockwise and anti-clockwise rotation magnetos.

Literature and engineering consultation are available on all Titeflex aircraft products. They include complete Harnesses, "Fleximold" Ignition Leads, "Unimold" Ignition Leads, "Aerocon" Conduit, "Waveflex" flexible wave guides, and high pressure flexible metal tubing. Your inquiry is invited.

Titeflex TITEFLEX, INC., 510 Frelinghuysen Avenue, Newark 5, N. J.

Famous Aircraft Products by Standard Pressed Steel



The Internal Wrenching Bolt (A) and 100° Flush-Head Socket Bolt (B) fully meet the extreme degree of precision tensile, fatigue and inspection demanded by the aircraft industry. Their close tolerances are only possible through our trained craftsmen and modern precision equipment. They facilitate compact designs, save space and weight. In sizes from #4 to 1½"; write for the "Unbrako" Catalog.

UNBRAKO

Reg. U. S. Pat. Off.

The "Unbrako" Socket Set Screw with the Knurled Cup-Point is a *Self-Locker*, because the knurled point digs-in and positively won't budge in spite of the most stubborn vibration! Yet, this screw can easily be backed-out with a wrench and used again and again. In sizes from #4 to 1½" write for the 'Unbrako' Catalog.

Pat'd and Pats. Pend.

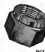
UNBRAKO

Reg. U. S. Pat. Off.

The "Unbrako" Socket Head Cap Screw of superior strength can be used 'most anywhere. Its knurled head provides a slip- and fumble-proof grip, even for oily fingers while its internal wrenching feature facilitates compact designs and the saving of weight. In sizes from #4 to 1½"; write for the "Unbrako" Catalog.

FLEXLOC

'Flexloc" Self-Locking Nut is of one-piece all metal construction so every thread, including the locking threads carries its share of the load—hence maximum utility in minimum space. Thin nuts made thus are especially superior. Its milled, flexible top locks on a wide range of tolerances. Practically unaffected by heat to 550° F. It can be used over and over again without losing its ability to lock. Sizes from #6 to 1" in diameter; coarse and fine threads millions of Aircraft "Flexloc" Self-Locking Nuts in use. Write for Bulletin #582.



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"HALLOWELL' TOOL KITS . . . seven different combinations are modern MUSTS. The hollow handle of Celanese* plastic contains the necessary, interchangeable tool bits of superior alloy steel. Bits chucked as shown, when used. Their every-day and everywhere usefulness has made them immensely popular.

"Unbrako" and "Hallowell" products are sold entirely through distributors.

Knurling of Socket Screws originated with "Unbrako" in 1934.

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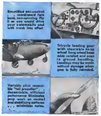
Waco Aristocraft

The aristocrat of privately owned planes. Designed to give you the utmost in safety, simplicity, comfort and convenience. The four-passenger Aristocraft is built for the flying in your future . . . whether for pleasure or business. Details and price on request.

A Better Plane for Safer, Easier Flying



THE WACO AIRCRAFT COMPANY, 1610 PETERS AVENUE, TROY, OHIO, U.S.A.

4 big reasons for selling AEROMATIC PROPELLERS

Latest 4-place personal planes on the market, North American Navions are equipped with Aeromatics . . . cruise at 150 m.p.h. . . . have a range of 700 miles.

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An Aeromatic Propeller has a high market value . . . makes more money for you . . . because it does so much to improve a light plane's performance.

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Aeromatic Propellers are easier to sell than most high quality equipment . . . because their advantages are so basic, so simple to demonstrate to a prospect.

3 Build Better Customers

Aeromatic owners are better buyers of your other goods and services. They buy more . . . because they fly more . . . because they get more fun out of flying their Aeromatic-equipped planes.

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Better take-offs, climbing, cruising and landings make enthusiastic Aeromatic owners eager to convince their fellow pilots of these benefits.

BETTER TAKE-OFF, CLIMBING, CRUISING, LANDING MAKE MANY PRIVATE FLIERS AEROMATIC PROSPECTS

Aeromatic Propellers have that ideal combination of yielding a profitable return on the initial sale . . . and helping bring *more business* your way thereafter. And there's the further advantage of selling an exclusive item, too . . . since Aeromatic is the *only* fully automatic variable pitch propeller!

Without any controls or gadgets, the Aeromatic Propeller varies its own pitch in response to natural forces . . . utilizes full engine power at rated speed . . . insures maximum performance under all flight conditions. That means up to 33% shorter take-off runs . . . up to 25% faster climbing . . . top cruising performance on minimum fuel consumption . . . long, flat glides for landing with a quick pick-up if pilot overshoots his field.

Performance like that makes Aeromatic Propellers easier to sell . . . insures satisfied customers. If the planes you are now selling do not already include Aeromatic Propellers as standard or optional equipment . . . write today to your distributor or manufacturer. Point out how Aeromatic can do the double job of improving flight efficiency and boosting profits for the planes you sell! Aeromatic, 640 Scott Street, Baltimore 3, Maryland.

AEROMATIC PROPELLERS ARE ALSO FACTORY EQUIPMENT ON:

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Air-controlled automatic propeller

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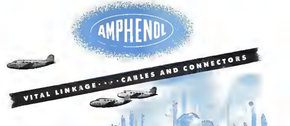
Licensed under patents of EVEREL *Propeller Corp.*

KOPPERS COMPANY, INC. BARTLETT HAYWARD DIVISION



Airborne communications equipment has reached an all time high in efficiency and dependability. In addition to radio, many of the new passenger ships will carry absolute altimeters, navigation and "blind landing" equipment, built on radar principles. In the postwar era of commercial flying—just as during the war—Amphenol will furnish the major portion of the cables, connectors and fittings used in all of these applications as well as on remote control, automatic control and indicator circuits.

One of the most valuable assets of Amphenol connectors (attested by electronic engineers and maintenance men alike), is the positive-contact, quick-disconnect feature. Thus, a plane need never be grounded for faulty radio or radar—an operable unit may be substituted in a matter of a few minutes, or even seconds. The repairs can then be made, with ample time and space, in the shop while the plane continues on its scheduled flight.

Amphenol cables and connectors are ruggedly built, mechanically and electrically correct—and for every known application. For quality, efficiency and dependability—for the most complete line of cables, conduits, connectors, fittings, plugs and plastic parts offered by one manufacturer—look to Amphenol.

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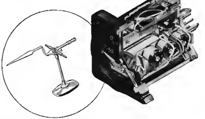
In Canada • Amphenol Limited • Toronto

COAXIAL CABLES AND CONNECTORS • INDUSTRIAL CONNECTORS FITTINGS AND CONDUIT • ANTENNAS • RADIO COMPONENTS • PLASTICS FOR ELECTRONICS

EDISON

Thermometer Indicators are mechanically simple



The only moving part *is this assembly of magnet and pointer on balanced pivot staff — no current-carrying hairsprings — no moving coils.*

Designed especially for Aircraft Service, they are Rugged, Accurate, Light in Weight, Free from Maintenance

EDISON AIRCRAFT THERMOMETER INDICATORS are simple. Maintenance is at a minimum because, quite literally, you can "fix an Edison Indicator with a hairpin." No hairsprings, no moving coils; the magnet-and-pointer assembly is the only moving part.

This ratio-type, moving-magnet indicator is not only simple and light in weight, but fully accurate under all conditions. It automatically compensates for battery-voltage fluctuations, and for ambient temperature variation between—65°F. and 160°F. Leads between indicator and bulb are of light-gage copper wire, and variations in lead length need not be compensated. All calibration is done, in a matter of seconds, with built-in rheostats.

The exclusive Edison moving-magnet design gives you these accuracy factors with simplicity of construction and maintenance. Any shop man can fix the instrument, or re-calibrate it, in a matter of minutes.

Ruggedness, accuracy, freedom from maintenance, and ease of disconnection and reconnection explain why hundreds of thousands of Edison Thermometer Indicators have been made and flown. Weight 0.7 lb. (single), 1.0 lb. (dual). For indicating temperatures of oil, coolant, carb. air, carb. mixture, cabin air, free air, heating ducts, and cylinder heads.

Edison publication No. 3005 gives full information on construction, sizes, styles, and ranges available. Address Instrument Division, Dept. E, Thomas A. Edison, Incorporated, West Orange, New Jersey.

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The Red Elastic Collar provided perfect protection against LIQUID SEEPAGE!

Wartime. A fighting plane crashes into the sea. $2\frac{1}{2}$ years later, a salvage crew fishes out the plane's battered, corroded tailpiece. Its alloy frame has been eaten away, but the ESNA fastened steel reinforcing piece is still intact. A wrench is applied to one of the Elastic Stop Nuts. It is removed with ease. Why? Study the unretouched photos. Note the bright, rust-free working threads. Here again, the self-sealing Red Elastic Collar has prevented the liquid seepage that would have caused an ordinary fastener to rust tight during its $2\frac{1}{2}$ years' submersion.

As this unusual occurrence proves, ESNA Elastic Stop Nuts can be depended upon to provide permanent protection against Liquid Seepage that causes Corrosion. They also protect permanently against Vibration, Thread Damage, and Costly Maintenance. Order Elastic Stop Nuts for maintenance. Specify them on new equipment. Or let ESNA study your specific fastener problems. Address: Elastic Stop Nut Corporation of America, Union, New Jersey.

ESNA Sales Engineers and Distributors are located in many principal cities for your convenience.

LOOK FOR THE RED COLLAR
THE SYMBOL OF SECURITY

It is threadless and permanently elastic. Every bolt — *regardless of commercial tolerances* — impresses (does not cut) its full thread contact in the Red Elastic Collar. This threading action produces a compressive, *radial* reactive pressure against *both* the top and bottom sides of the bolt threads inside the nut . . . insures a permanently tight, full contact between the bolt and nut threads . . . and makes all Elastic Stop Nuts self sealing against Liquid Seepage.

As a result, all Elastic Stop Nuts protect permanently against thread corrosion and subsequent thread failure.

ELASTIC STOP NUTS

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PRODUCTS OF: ELASTIC STOP NUT CORPORATION OF AMERICA

METAL is Saved and REJECTS are Fewer

When "N.C.R.'s Die-Caster Pots Have Micromax Pyrometers

Big die-caster pot gets automatic Micromax temperature control, in National Cash Register Co.'s Dayton, Ohio plant. Photo shows pot partly dismantled for maintenance. Above, twelve Micromax Recorders and one Controller.

The problem of holding correct temperatures in die-caster pots is greatly simplified for National Cash Register Co. by the Micromax Pyrometers shown above. Some of the Pyrometers are Recorders, others are fully-automatic Controllers . . . the selection depending on the type of work being handled.

In either case, automatic instrumentation has proved a good investment. Regarding the Controllers, the superintendent says that "no man could hold the same even temperature, even if he stood by a caster pot and watched temperature all the time. Micromax helps save metal and fuel, by making the die casting more accurate and by reducing the number of rejects."

Perhaps you have a similar problem. For specific details on how Micromax Pyrometers can be applied, write us describing your needs. Or mention N-33A, if you prefer a Catalog.

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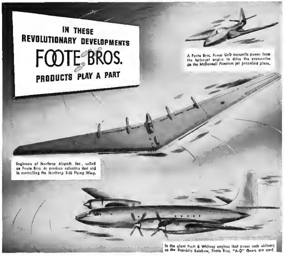

A Foote Bros. Power Unit transmits power from the turbo-jet engine to drive the accessories on the McDonnell Phantom jet propelled plane.

Engineers of Northrop Aircraft, Inc., called on Foote Bros. to produce actuators that aid in controlling the Northrop B-35 Flying Wing.

In the giant Pratt & Whitney engines that power such airliners as the Republic Rainbow, Foote Bros. "A-Q" Gears are used.

The world is witnessing revolution in aircraft design. Huge *airliners* span oceans in a matter of hours. *Jet propelled planes* fly at speeds approaching the velocity of sound. Mammoth *flying wings* offer a radical approach to transportation of the future. Radical too are the gears and power units developed to meet the demands of engineers willing to break with tradition.

The reason so many aircraft manufacturers call on Foote Bros. for gears and power units, is found in the experience of this company to do the almost impossible in power transmission.

If your problem is one requiring extremely high speeds, light weight, compact design or low noise level, the solution may be "A-Q" (aircraft quality) gears. If you require a unit to actuate linear or rotary motion—on an exact time cycle or within close limits—Foote Bros. can develop a Power Unit to meet your needs.

Our engineers will help you find the answer to any problem in gearing or power application.

A recently issued bulletin on Power Units giving complete engineering data on "packages of power," will be sent on request. Also available is a bulletin on Aircraft Quality Gears. Mail the coupon.

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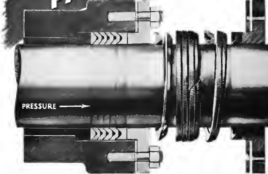
PRESSURE


COLONIAL AIRLINES



BG

PULLMAN-STANDARD BUILDS BETTER CARS

. . . builds them faster with Reed & Prince Recessed Head screws and power bits!

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Wood Screws Sheet Metal Screws
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Also
Cap Screws Set Screws
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Rivets and Burrs Rods
Screw Drivers and Bits
Specialties

IN hard-to-reach driving positions (as well as everyday production) many of the Nation's leading manufacturers such as the Pullman-Standard Car Manufacturing Company, have found the answer to the secret of fast, accurate assembly in the use of the Reed & Prince Recessed Head screw or bolt with the Reed & Prince driver or bit!

Another feature — elimination of costly scratches and scars on inside car construction and trim, is equally as important as accuracy and speed to Pullman-Standard production!

One driver or bit (not 3 or 4 sizes) completes the workman's kit! Loss of time is cut because any Reed & Prince driver or bit will fit any size or style Reed & Prince Recessed Head screw or bolt!

For the answer to your assembly problem — be it large or small — use the Reed & Prince combination . . . featuring the recess that is "A HEAD of the Times"!

REED & PRINCE MFG. CO.

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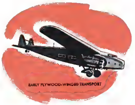
Exact fit of driver or bit allows even distribution of centered driving pressure on all parts of the recess.



1929

FIRST SYNTHETIC COATING FOR AIRCRAFT —Early plywood-winged transports, forerunners of today's all-plywood aircraft, were finished with the first synthetic coating commercially produced for aircraft—one of a long line of finishing firsts scored by the Murphy Varnish Company, recently joined with Ault & Wiborg to form the Finishes Division of Interchemical Corporation.

WORLD WAR II

THE FINISH THAT MADE WAR PLANES INVISIBLE—Another Interchemical first was the development of a "Mirror Black" paint for aircraft which had 1/50 the diffuse reflectivity of the dullest mat blacks previously produced. Use of "Mirror Black" on night fighters and bombers made them virtually invisible in the glare of enemy searchlights. This Interchemical Finish contributed much to the success of the Army Air Force's famed P-61, "Black Widow," in the Pacific Campaign and in night operations over Japan.

TODAY

"A MURPHY AIRCRAFT FINISH"* FOR EVERY TYPE AIRCRAFT—Murphy Aircraft Finishes, because of their characteristic high solids content, blush resistance, flexibility of film, freedom from "orange peel," and good covering qualities, have been responsible for substantial savings in finishing time and production costs. If you are planning to manufacture a new model, having trouble with your present finishing or refinishing operation, or are planning to change and modernize your production line set-up—REMEMBER—To give your product a good start, give it "A Murphy Aircraft Finish."

Write: Interchemical Corporation, Finishes Division, Empire State Bldg., 350 Fifth Ave., New York 1, N.Y.

*Made by the Interchemical Corporation, Finishes Division, a result of the recent consolidation of the business of Ault & Wiborg Division of Interchemical Corporation and that of the Murphy Varnish Company, both manufacturers of fine industrial finishes for more than 75 years.

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AN INTERCHEMICAL PRODUCT

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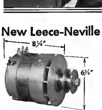

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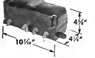
WEIGHT . . . . 30 Pounds
RATING . . 14 Volts—100 Amperes



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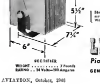

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Similar 3-unit system for 6 volt service. RATING: 60 Amperes 420 Watts. SYSTEM WEIGHT: 40 Pounds

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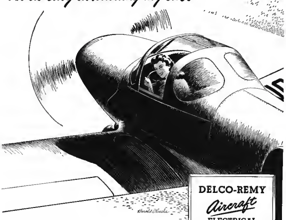

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Electric Starting for Convenience and Safety . . . Ample Current for Lights, Radio, Accessories

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DIVISION, GENERAL MOTORS CORPORATION

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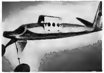
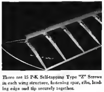


P-K binding head Type "Z" Screws fasten cabane to fuselage. Slots permit wing assembly to be moved back when model is changed over from "Class B" to "Class C", with heavier motor.



There are 15 P-K Self-tapping Type "Z" Screws in each wing structure, fastening spar, ribs, leading edge and tip securely together.

Model builders with an average amount of skill and ordinary household tools can put this nifty little plane together without any trouble, thanks to the simpler P-K fastening method

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Write for free booklet which contains valuable information about the care and repair of wood propellers, and lists Sensenich model numbers for all types of aircraft powered under 250 HP.

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REPAIR SEXVICE—*Propeller need repairing? Send it to a Sensenich PROP-SHOP. Prompt, efficient service on all makes of wood propellers. Denver and West please use Glendale plant.*

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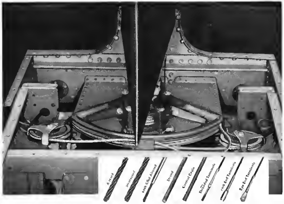

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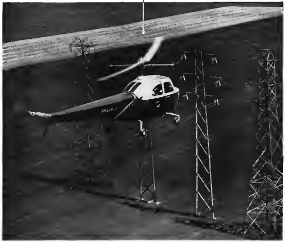

There's a rumor around that the helicopter will mow your lawn, paint your house, and put the children to bed. It's good, but not *that* good. Here's what it *really will* do.

The Bell Helicopter can cruise high or low at any speed from 80 to 1 m.p.h. It can fly backward or sideways. It can ascend or descend vertically. Or haul up short and hover while its occupants study the job at hand. At all times, a patented stabilizing bar assures a steady ride.

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Today's Bell Helicopters are the product of intense research and development by some of America's top designers and aeronautical engineers. Pilots, trained by Bell, will be available to owners of the Bell Helicopters. Find out now what the Bell Helicopter can mean to you in your business. For full details, write Helicopter Division, Bell Aircraft Corporation, P. O. Box 1, Buffalo 5, New York.

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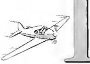

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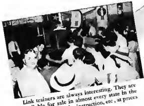
WAR ASSETS ADMINISTRATION



Link trainers are always interesting. They are available for sale in almost every state in the country. Suitable for instruction, etc , at prices below government cost

Here is one of the many radial engines for disposal You are urged to consult our representative regarding types and sizes available.

Part of the display of the huge stock of tires in war surplus. Many sizes, types and treads are available for immediate delivery.

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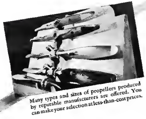
Instruments, tires, engines, electrical equipment and replacemeot parts are offered at attractively low prices. To keep flying—to keep your plane safe, dependable and modern—check your needs at the Cleveland National Aircraft Component Sales Center of the War Assets Administration.

Non-profit & Tax supported Institutions—you may obtain aeronautical property at nominal cost for instruction or research. Write to Director, Education of Aircraft Division, Room 319, Annex 2, 425 Second St., N. W., Washington 25, D. C.



Many types and sizes of propellers produced by reputable manufacturers are offered. You can make your selection at less-than-cost prices.

Detailed information regarding the sale of aircraft can be obtained from any W.A.A. Regional Office.

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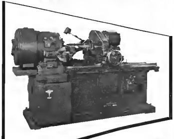

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For more information on any products or services advertised in this issue, indicate in coupon on page 119, the key number as listed before each advertiser

1 Aerial Products, Inc 141
2 Aircraft Components Corp 137
3 Airedic, Inc 198
4 Allen Co., Inc., L B 195
5 Allen Mfg Co., The 122
6 Aluminum Co. of America 114
7 American Chain & Cable, Inc 82
8 American Flange & Mfg Co., Inc. 131
9 American Gas Accumulator Co 188
10 American Magnesium Corp 103
11 American Machine & Metals, Inc. 148
12 American Phenolic Corp 155
13 American Screw Co 200
14 American Steel & Wire Co 173
15 Arens Control, Inc. 190
16 Armstrong Brothers Tool Co 148
17 Associated Seed Growers, Inc 100
18 Atlantic Screw Works 200
19 Atlas Bolt & Screw Co. 200
20 Automotive & Aircraft Div 92
21 Aviation Corp, The (Lycoming Div) 139

22 Barber-Colman Co 149
23 Bartlett Hayward Div 164
24 Bell Aircraft Corp 183
25 Bendix Aviation Corp Back Cover
26 Berry Brothers, Inc 9
27 B G Corporation, The 193
28 Bond Foundry & Machine Co 125
29 Booth Felt Co., The 138
30 Bower Roller Bearing Co 199

31 Carnegie-Illinois Steel Corp. 7
32 Cantilever Hangar Syndicate 195
33 Central Screw Co 200
34 Chandler Evans Corp. 172
35 Chandler Products Corp 200
36 Chicago Rawhide Mfg Co. 116
37 Collins Radio Co 110
38 Columbia Steel Co 173 7
39 Consolidated Vultee Aircraft Corp. 194
40 Continental Diamond Fibre Co. 102
41 Continental Screw Co. 200
42 Corbin Screw Div Amer Hdw Co 200
43 Curtiss Wright Corp (Airplane Div) 8

44 Darnell Corp., Ltd 128
45 Delco Remy 170
46 Dill Mfg Co., The 189
47 Douglas Aircraft Co Inc 123
48 Dow Corning Corp 137
49 DuPont de Nemours & Co. Inc E. I 33

50 Eastman Kodak Co. 98
51 Edison Inc., Thomas A. 158
52 Elastic Stop Nut Corp 157
53 Electric Storage Battery Co. 174

54 Faber Inc., A W 159
55 Federal Aircraft Works 194
56 Federal Bearings Co. Inc The 176
57 Firestone Tire & Rubber Co. The 30, 31
58 Fitzgerald Mfg Co 184
59 Foote Bros. Gear & Machine Corp 181
60 Formica Insulation Co 185

61 General Electric Co. (Apparatus Div) 24, 25
62 Glidden Co., The 28
63 Globe Steel Tubes Co 135
64 Goodall Fabrics Inc 171
65 Goodrich Co., The B F 149
66 Goodyear Tire & Rubber Co. 4
67 Govro-Nelson Co 160
68 Gulf Oil Corp 127

69 Hansen Mfg Co 29
70 Harper Co., The H. M. 200
71 Harbord Corp., The 156

72 Interchemical Corp. 165
73 Inteva, Inc. 164
74 International Screw Co. 200
75 Irving Air Chute Co., Inc. 144 142

76 Jack & Heintz Precision Industries, Inc 108

77 Keuffel & Esser Co. 138 15
78 Kester Solder Co. 188
79 Kidde & Co., Inc., Walter 143
80 Kilgore Mfg Co., The 141
81 Kohler Company 178
82 Kollsman Instrument Co. 6
83 Koppers Co. 154

84 Lamb Electric Co., The 175
85 Laminated Shim Co., Inc 129
86 Lawson & Sessions Co. 200
87 Leece-Neville Co., The 167
88 Leeds & Northrup Co 160
89 Lindsey Air Radio, Inc 185
90 Lineer, Inc 162
91 Lockheed Aircraft Corp 145
92 Lord Mfg Co 108
93 Lucas Ltd, Joseph 18, 19

92 McGraw Hill Book Co. 191 189
93 Manhattan Rubber Div 191
94 Manufacturers Screw Products 200
95 Market Place 195, 196 197
96 Milford Rivet & Machine Co. 200
97 Murdock Co., Wm. J. 142

98 National Lock Co 200
99 National Screw & Mfg Co., The 200
100 New Departure 84
101 New England Screw Co 200
102 North American Aviation Inc 14

103 Ohio Seamless Tube Co., The 112
104 Onan & Sons D W 133

105 Pacific Gear & Tool Works 26
106 Packard Electric 179
107 Parker Kalon Corp 200, 189
108 Pawtucket Screw Co 200
109 Permutex Co., Inc 53
110 Permoflux Corporation 139

111 Pheoll Mfg Co 200
112 Phillips Petroleum Co 98
113 Phillips Screw Manufacturers 200
114 Pittsburgh Plate Glass Co 124
115 Plomb Tool Co 26
116 Pyrene Mfg Co 134

117 Raybestos-Manhattan, Inc 151
118 Reading Screw Co 200
119 Reed & Prince Mfg Co 164
120 Republic Aviation Corp 166
121 Revere Copper & Brass Inc 165
122 Reynolds Metals Co 17
123 Roe & Co., Ltd., A V 97
124 Roebling's Sons Co, John A 182
125 Russell, Burdsall & Ward Bolt & Nut Co 200
126 Russell Mfg Co 140
127 Ryerson & Son, Inc., Jos. T 118

128 Scovill Mfg Co 200
129 Sensenich Brothers 181
130 Shakeproof, Inc 200
131 Silent Hoist & Crane Co 146
132 Sikorsky Aircraft Front Cover
133 Sinclair Refining Co 130
134 Snap On Tools Corp 18
135 Solar Aircraft Co 129
136 Southington Hardware Mfg Co., The 200
137 Sperry Gyroscope Co., Inc 11
138 Standard Pressed Steel Co 152
139 Steel Co. of Canada Ltd, The 200
140 Sterling Bolt Co 200

141 Tennessee Coal, Iron & RR Co. 173, 7
142 Thompson Products, Inc Second Cover
143 Thornton, Inc., Harris W 32
144 Ticeo, Inc 177
145 Timken Roller Bearing Co, The 24
146 Tinnerman Products, Inc Third Cover
147 Tuellor Inc 150, 151
148 Torrington Company, The 132

149 United States Gauge Div 145
150 United States Plywood Corp 140
151 U S Rubber Co 147
152 U. S. Steel Corp 173, 7
153 U. S. Steel Export Co 173, 7
154 Utica Drop Forge & Tool Corp 191

155 Vickers, Inc 99
156 Vinco Corp 21, 22 33

157 Waco Aircraft Co, The 153
158 Waldes Kohinoor, Inc 169
159 War Assets Administration 162, 163, 186 167
160 Weber Showcase & Fixture Co., Inc 34
161 Western Gear Works 39
162 Where To Buy 185
163 Whittaker Co., Ltd., Wm. R 18
164 Whitehead Stamping Co 194
165 Wolverine Bolt Co 200
166 Wright Aeronautical Corp 12, 13
167 Wyman-Gordon 131

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AVIATION'S MARKET PLACE

CLASSIFIED DISPLAY ADVERTISERS

BOOKS 196
EMPLOYMENT (Positions Wanted and Vacant) 196
FOR SALE 187, 197
PROFESSIONAL SERVICES 196

CLASSIFIED DISPLAY ADVERTISERS

Aero Wrades Co 196
Allied Aircraft Co 197
Kaar & Co., Inc 196
Lancaster, Allwine & Rommel 198
Markeofer, Lawrence J 196
McDonnell Aircraft Corp 195
Pan American Navigation Service 196
Standard Aircraft Equipment Co 196
American Warehouse 197
Aero Consulting Service 196
Eastern Mchy. Co., The 197
Eddy W W 197